Check List the journal of biodiversity data

ANNOTATED LIST OF SPECIES

Check List 18 (6): 1279–1319
https://doi.org/10.15560/18.6.1279

PENSOFT.

An updated checklist of vascular epiphytes in the Darjeeling Himalaya, India

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Abstract. The Darjeeling Himalaya, located in eastern part of the Himalaya biodiversity hotspot in India, is known for its diverse vegetation. The varying climatic conditions along the elevational gradient provide suitable habitats for supporting a rich flora in the region. We provide an updated checklist of vascular epiphytes in Darjeeling Himalaya. A total of 239 vascular epiphyte species belonging to 93 genera and 38 families have been recorded from the region, which include holoepiphytes, hemiepiphytes, facultative and accidental epiphytes. Orchidaceae was the largest family with 70 species, followed by Polypodiaceae comprising 42 species. We make available baseline biodiversity information on vascular epiphytes of the study area and provide details on taxonomic diversity and distribution in terms of vegetation types and along the elevational gradient. We also provide photographs to facilitate field identification.

Keywords. Distribution, ferns, inventory, orchids, phenology, taxonomy, vegetation

Academic editor: Anzar Khuroo
Received 25 June 2022, accepted 27 November 2022, published 16 December 2022

Rai P, Moktan S (2022) An updated checklist of vascular epiphytes in the Darjeeling Himalaya, India. Check List 18 (6): 1279–1319. https://doi.org/10.15560/18.6.1279

Introduction

The term "epiphyte" is derived from the Greek words "epi" (upon) and "phyton" (plants) (Kumar et al. 2017). Epiphytes are defined as sessile, non-parasitic organisms that germinate and are structurally dependent on other plants (Zotz et al. 2021; Taylor et al. 2022). They may be categorised into holoepiphytes, hemiepiphytes, facultative, and accidental epiphytes based on life forms (Dawson 1988; Zotz 2005, 2016; Hoeber et al. 2019). Various forms and functions of vascular epiphytes can be found within the same microniche (Derzhavina 2019). The vascular epiphytes comprise around 10% of the world's total flora and are one of the most ubiquitous life forms in tropical forest canopies (Zotz 2013; Taylor et al. 2022). The common vascular epiphytes are mostly represented by monocots (75%) and eudicots (13%) (Zotz 2013). Angiosperms, such as Orchidaceae, and ferns, such as Polypodiaceae, are mostly epiphytic representing 75% and 89% of the total number of species worldwide, respectively (Taylor et al. 2022). However, some angiosperm families like Asteraceae and Poaceae represent less than 1% and gymnosperms contribute less than 0.2% of all epiphytic forms, while families like Brassicaceae, Euphorbiaceae, and Fabaceae have no epiphytic representatives (Zotz et al. 2021).

Epiphytes are scientifically interesting model organisms in shaping community assembly. They contribute significantly to forest structure and ecosystem functions and provide shelter to diverse flora and fauna (Angelini and Silliman 2014; Méndez-Castro et al. 2018). They play a key role in primary productivity, biomass, litterfall, and maintenance of biodiversity (Gentry and Dodson 1987; Benzing 1995; Barthlott et al. 2001; Muñoz et al. 2003). Additionally, epiphytic abundance greatly impacts forest nutrients and water cycling (Gotsch et al. 2016) and has a considerable contribution to biomass of other plant forms (Zotz 2016). Furthermore, epiphytes also act as an ecological indicator (Benzing 1990) while assessing the effect of deforestation and invasion of secondary vegetation and plantations (Hietz et al. 2006).

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Despite their significance, many ecological factors have an impact on epiphytic species diversity patterns (Chawla et al. 2008). Some environmental variables including temperature, wind speed, relative humidity and precipitation are important limiting factors for epiphytic species composition and diversity (Yam et al. 2010; Sanger and Kirkpatrick 2017). Similarly, elevation is another important factor in its spatial distribution (Ding et al. 2016; Ortiz et al. 2019; Barbosa et al. 2020). However, a study on species richness and diversity patterns along an elevational gradient has not been established well (Bhattarai and Vetaas 2003). With elevation, geographic and climatic conditions also change sharply (Kharkwal et al. 2005; Saiz et al. 2021).

The frequent occurrence of some epiphytic traits such as fleshy leaf and succulent stems (Gobel et al. 2020), crassulacean acid metabolism photosynthesis (Benzing 1987), aerial roots (Einzmann et al. 2019), or an impounding leaf base (Zotz et al. 2020) suggest that water availability is a significant parameter for epiphytes (Ding et al. 2016; Zuleta et al. 2016). Besides, vegetative growth and spatial distribution of epiphytes are mainly limited by host tree traits (Wagner et al. 2015), including tree architecture (Cardelus and Chazdon 2005; Einzmann et al. 2015) and bark texture, pH, and rugosity (Timsina et al. 2016; Adhikari et al. 2016), diameter (Wang 2016), growth rate (Flores-Palacios and Garcia-Franco 2006), and canopy size (Wagner and Zotz 2020). Concurrently, the habitat provided for other organisms in the complex host canopy aids in enriching biodiversity (Azuma et al. 2022). Vascular epiphytes flourish well in host trees having larger and thicker trunks (Sillett and Pelt 2007). Thus, host tree traits and tree microclimate influence the epiphytic species richness, composition, and abundance (Zotz et al. 1999; Laube and Zotz 2006).

The Himalaya, a remarkably diverse and globally important mountain range, harbours a rich biological diversity and has drawn considerable attention from many researchers (Sharma et al. 2019). The Himalaya provides precious ecosystem services to a large proportion of the population in South Asia (Schild 2016). However, the region is highly vulnerable to climate and land-use changes and other natural and anthropogenic disturbances (Palni and Rawal 2010). Lying in the foothills of the eastern Himalaya, the Darjeeling Himalaya possesses a rich and unique floral diversity distributed in different micro-climatic conditions (Das 1986; Bhujel 1996).

The plant exploration in this region dates back one and half centuries. Sir J.D. Hooker first published the flora of Tonglu (Hooker 1849). Subsequently, list of trees, shrubs, and climbers growing in forests of Darjeeling Himalaya were documented (Gamble 1875, 1896). Furthermore, three volumes of the *Flora of Eastern Himalaya* describe plants from this region (Hara 1966, 1971; Ohashi 1974). Similarly, another important publication *The Flora of Bhutan* also enumerated several plant species from this region (Grierson and Long 1983, 1984, 1987, 1991, 1999, 2001; Noltie 1994, 2000; Pearce and Cribb 2002). Some other notable floristic works included phanerogamic plants (Yonzone 1976), a palynological study (Das 1986), dicots (Bhujel 1996), angiospermic climbers (Samanta 1998), tea-garden weeds (Ghosh 2006), characterisation using remote sensing (Rai 2006), monocots (Nirola 2015), orchids (Yonzone 2015), pteridophytes (Thapa 2016), phytosociological studies (Moktan 2017), and a checklist on dicots (Mallick 2020). However, a thorough study on the vascular epiphytic flora from the region is still lacking. No detailed study to date has specifically focused on the vascular epiphytic flora of the region. A comprehensive checklist of vascular epiphytic species along with their host trees will be the starting point in filling this knowledge gap. Therefore, we present a checklist of the vascular epiphytic flora of Darjeeling Himalaya with details on taxonomic information, distribution, and ecology of species. Our study also investigates the species composition and similarity in vascular epiphytic flora between vegetation types. The resulting taxonomic information and details about distribution of vascular epiphytes in the study region may provide a valuable baseline information for future research.

Study Area

The present study was conducted in Darjeeling Himalaya, an integral part of the eastern Himalaya. The region experiences a wide array of climatic and ecological zones representing a unique variety of plants (Das 1995; Basnet et al. 2019). The study area lies in the northernmost zone of the Indian state of West Bengal. The area is bordered by Sikkim, Nepal, and Bhutan in the north, west, and east, respectively. Elevations range from 98 m to 3636 m asl. The northernmost point of the region is the tri-junction near Phalut (27°13.16′N, 088°21.00′E) and the southern-most point is the Phansidewa block (26°27.08′N, 088°22.00′E). The west to east extension lies between Sabarkum near Sandakphu (27°12.00′N, 087°59.50′E) and Todey village along the river Jaldhaka (27°04′N, 088°53′E). There are two national parks and three wildlife sanctuaries with a total forest cover of about 2368 km^2 (ISFR 2019). There are also several reserved, unreserved, and social forests within the study area.

The vegetation of Darjeeling Himalaya extends from the tropical plain to the subalpine zone and the region is renowned for its high diversity of vegetation in India (Rai and Lama 2016; Cajee 2018). The vegetation of the study area has been classified according to altitudinal ranges (Gamble 1875; Cowan and Cowan 1929; Champion 1936; Champion and Seth 1967). Bhujel (1996) later modified the classification to incorporate both climate and elevation as Tropical (TRP, plains to 500 m), subtropical (STR, 500–1200 m), subtemperate (STM, 1200–1850 m), temperate (TMP, 1850–3200 m), and subalpine (SAL, above 3200 m) (Fig. 1).

Due to its distinctive topography and elevational range, the climate in this region varies greatly, with

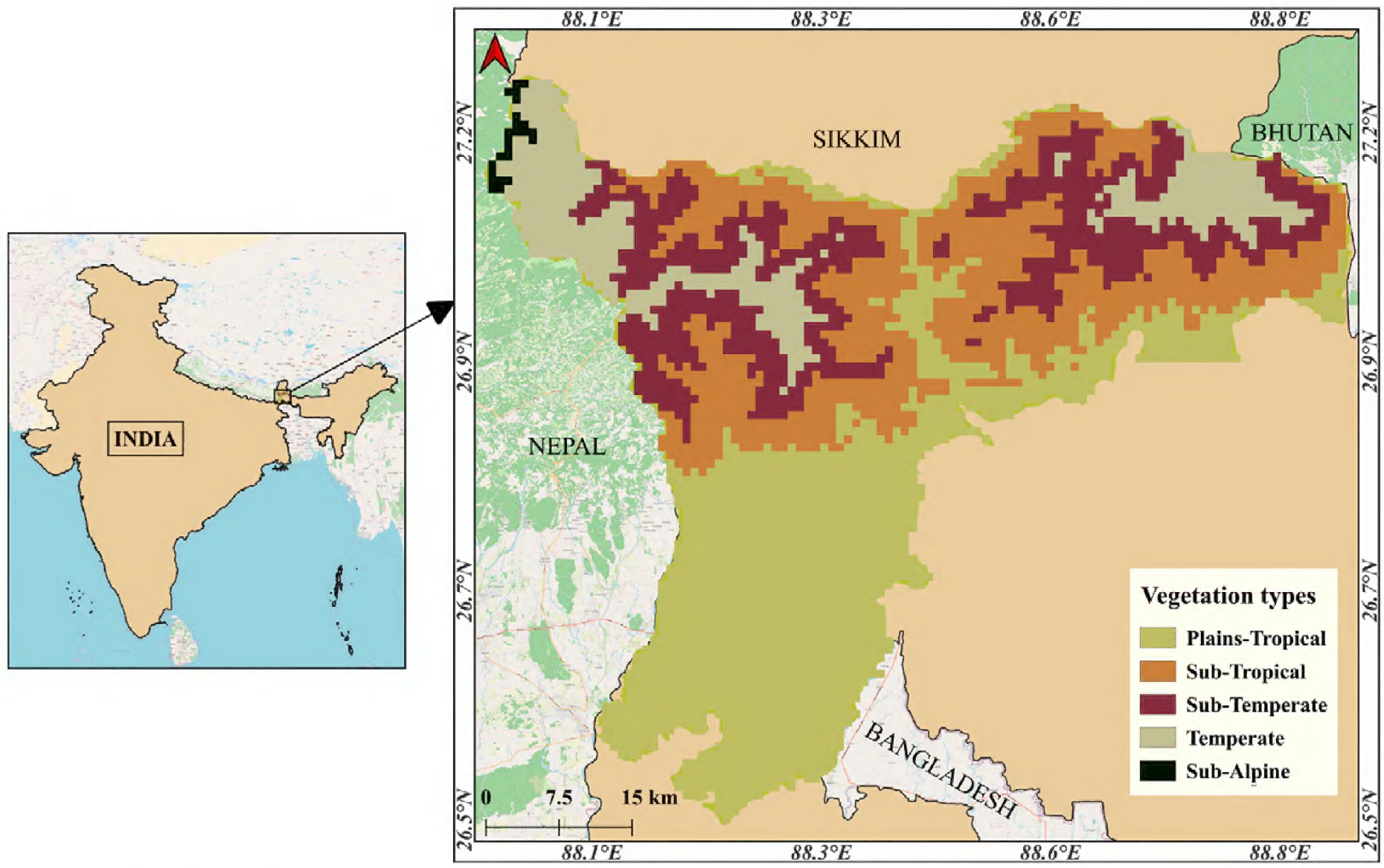

Figure 1. Map of the study area showing vegetation types.

small microclimatic zones along elevational ranges. The area has four defined seasons: winter from December to February, spring and summer from March to May, monsoon or rainy season from June to August, and autumn from September to November (Bhujel 1996). The average monthly temperature varies from a maximum of 24 °C in August to a minimum of 2 °C in January. The annual precipitation is about 2400 mm. Most places in the region receive the maximum rainfall from June to October (Mandal and Sarkar 2021). July and August are usually the hottest months, while the coldest month is January (Cajee 2018). The relative humidity is highest from June to September (95–100%).

Methods

Data collection. We carried out extensive field surveys from 2019 to 2021 in different forests of the Darjeeling Himalaya at lower to higher elevations. During our field surveys, around 25 plots, each 30 × 30 m, were employed in each vegetation type to sample individual host trees. However, vascular epiphytes were sampled on a plotless basis, based on the presence of epiphytic species on individual host trees (Wolf et al. 2009).

During the surveys, we focussed on the forest understory and on the dominant host tree to locate vascular epiphytes. Specimens were photographed and collected in the field. In some cases, an expert local tree climber helped to collect the specimens. The specimens at the inner crown zone of host trees were recorded using Vanguard Spirit XF 8 × 42 binoculars. Our voucher specimens were processed using standard methodology (Jain and Rao 1977). We also noted the phenological status of each species in the field during pre-monsoon, post-monsoon, and winter seasons, excluding higher elevational zones. We identified our specimens using the relevant literature (Hara 1966, 1971; Ohashi 1972; Grierson and Long 1983, 1984, 1987, 1991, 1999, 2001; Pearce and Cribb 2002; Fraser-Jenkins 2008; Kholia 2010; Fraser-Jenkins et al. 2017, 2018, 2021). Lloyd Botanical Garden Herbarium and Calcutta University Herbarium (CUH) were also consulted for identifications. We consulted World Flora Online (WFO 2022) for current nomenclature and taxonomic authorities. The threat status of the recorded taxa was obtained from ThreatSearch (BGCI 2022). Mounted and labelled herbarium exsiccates were deposited in the Calcutta University Herbarium (CUH). The elevation and location of each study site were recorded with a Garmin eTrex H hand-held GPS receiver. The map of the study area was produced in QGIS Madeira v. 3.20 (QGIS 2022) and Venn diagram was prepared in R v. 4.1.1 using ggVennDiagram function (R Core Team 2013).

Taxonomic and nomenclatural curatorship. The classification proposed in APG IV (2016) and PPG I (2016) was followed for the arrangement of angiosperm and pteridophytic families, respectively. The recorded species are listed in Table 1 with details of family, life form, phenology/fertile period, vegetation types, geographic distribution, and voucher number. Vascular epiphytes were classified into different categories holoepiphytes (no contact to the ground), facultative (can grow both on host tree and ground), accidental (for plants that occasionally grow as epiphytes), and hemiepiphytes (for those plants that germinate in tree crown but latter establish a

Table 1. List of vascular epiphytes from the study area. Life form: Hol (Holoepiphytes); Hem (Hemiepiphytes); Fac (Facultative epiphyte); Acc (Accidental epiphyte). Vegetation types: TRP (Tropical); STR (Subtropical); STM (Subtemperate); TMP (Temperate); SAL (Subalpine). Geographic distribution: SEA (Southeast Asia); SAM (South America); NAM (North America); NAF (North Africa); AUS (Australia); EA (Eastern Asia); SAF (South Africa); NEU (Northeast Europe); EH (Eastern Himalaya); CAF (Central Africa); CAM (Central America).

Family	Taxon	Life form	Phenology/ fertile period	Vegetation types	Geographic distribution	Voucher number
MONOCOTS						
Araceae	*Colocasia affinis* Schott	Acc	July–Aug	TRP; STR	SEA	CUH 20164
	Pothos scandens L.	Hem	Dec–Jun	TRP; STR	SEA; EA	CUH 20252
	Remusatia pumila (D.Don) H.Li & A.Hay	Fac	May–Jul	STR; STM; TMP	SEA	CUH 20325
	Rhaphidophora calophylla Schott	Hem	Aug–Dec	TRP; STR; STM	SEA; EA	CUH 20181
	Rhaphidophora decursiva (Roxb.) Schott	Hem	Aug–Nov	STR; STM	SEA	CUH 20265
	Rhaphidophora glauca (Wall.) Schott	Hem	Sep–May	STM; TMP	SEA	CUH 20261
	Rhaphidophora hookeri Schott	Hem	Mar–Jul	TRP; STR	SEA	CUH 20132
	Scindapsus officinalis (Roxb.) Schott	Hem	Feb–Jun	TRP; STR	SEA	CUH 20259
Dioscoreaceae	*Dioscorea belophylla* (Prain) Voigt ex Haines	Acc	Oct–Jan	TRP; STR; STM	Indo-Nepal	CUH 20222
	Dioscorea bulbifera L.	Acc	June–Sep	TRP; STR; STM	SEA; SAM; SSA	CUH 20311
Orchidaceae	*Acampe rigida* (Buch.-Ham. ex Sm.) P.F.Hunt	Hol	May–Oct	TRP; STR	SEA; SAF	CUH 20170
	Aerides multiflora Roxb.	Hol	Mar–Sep	TRP; STR	SEA	CUH 20169
	Agrostophyllum myrianthum King & Pantl.	Hol	July–Sep	TRP; STR; STM	Eastern Himalaya	CUH 20306
	Agrostophyllum planicaule (Wall. ex Lindl.) Rchb.f.	Hol	July–Oct	TRP; STR; STM	SEA	CUH 20171
	Agrostophyllum stipulatum subsp. *bicuspidatum* (J.J.Sm.) Schuit.	Hol	Mar–Jul	STR; STM; TMP	SEA	CUH 20237
	Bulbophyllum affine Wall. ex Lindl.	Hol	May–Oct	STR; STM	SEA	CUH 20281
	Bulbophyllum appendiculatum (Rolfe) J.J.Sm.	Hol	Oct–Feb	TRP; STR	Indo-Bhutan	CUH 20290
	Bulbophyllum careyanum (Hook.) Spreng.	Hol	Oct–Feb	STR; STM	SEA; NAF	CUH 20250
	Bulbophyllum cauliflorum Hook.f.	Hol	Apr–Aug	STR; STM	SEA	CUH 20315
	Bulbophyllum crassipes Hook.f.	Hol	Sep–Dec	TRP; STR; STM	SEA	CUH 20191
	Bulbophyllum gamblei (Hook.f.) Hook.f.	Hol	Jun–Jul	STM; TMP	Indo-Bhutan	CUH 20221
	Bulbophyllum helenae (Kuntze) J.J.Sm.	Hol	Oct–Feb	STR; STM	SEA	CUH 20343
	Bulbophyllum hirtum (Sm.) Lindl. ex Wall.	Hol	Oct–Jan	STR; STM; TMP	SEA	CUH 20302
	Bulbophyllum leopardinum (Wall.) Lindl. ex Wall.	Hol	Jun–Nov	STM; TMP	SEA	CUH 20341
	Bulbophyllum melanoglossum Hayata	Hol	Jul–Oct	STR; STM	SEA; EA	CUH 20256
	Bulbophyllum odoratissimum (Sm.) Lindl. ex Wall.	Hol	Oct–Feb	STM; TMP	SEA	CUH 20208
	Bulbophyllum reptans (Lindl.) Lindl. ex Wall.	Hol	Aug–Oct	STM; TMP	SEA	CUH 20304
	Bulbophyllum rolfei (Kuntze) Seidenf.	Hol	Aug–Oct	STR; STM; TMP	SEA	CUH 20287
	Bulbophyllum roseopictum J.J.Verm., Schuit. & de Vogel	Hol	Oct–Jan	TMP	Indo-China	CUH 20114
	Bulbophyllum wallichii Rchb.f.	Hol	Oct–Jan	STR; STM; TMP	SEA	CUH 20255
	Coelogyne barbata Lindl. ex Griff.	Hol	Aug–Feb	STR; STM; TMP	SEA; SAF	CUH 20280
	Coelogyne corymbosa Lindl.	Hol	Apr–Jul	STR; STM; TMP	SEA	CUH 20300
	Coelogyne cristata Lindl.	Fac	Feb–Sep	STR; STM; TMP	SEA; SAM; NAM; NEU	CUH 20162
	Coelogyne fimbriata Lindl.	Hol	Sep–Dec	STR; STM; TMP	SEA; NAM	CUH 20245
	Coelogyne flaccida Lindl.	Hol	Mar–Jul	TRP; STR; STM	SEA; SAM; NAM; NEU	CUH 20130
	Coelogyne occultata Hook.f.	Hol	Mar–Jul	TMP; SAL	SEA	CUH 20301
	Coelogyne punctulata Lindl.	Hol	Oct–Jan	STR; STM; TMP	SEA; NAM	CUH 20236
	Cymbidium aloifolium (L.) Sw.	Hol	Apr–Jul	TRP; STR; STM	SEA; NAM; SAM	CUH 20187
	Cymbidium bicolor Lindl.	Hol	Apr–Aug	TRP; STR	SEA	CUH 20247
	Cymbidium eburneum Lindl.	Hol	Mar–Jul	TRP; STR; STM	SEA	CUH 20166
	Cymbidium elegans Lindl.	Hol	Oct–Jan	STM; TMP	SEA	CUH 20232
	Cymbidium erythraeum Lindl.	Hol	Aug–May	STM; TMP	SEA	CUH 20192
	Cymbidium hookerianum Rchb.f.	Hol	Mar–Aug	TMP	SEA	CUH 20349
	Dendrobium amoenum Wall. ex Lindl.	Hol	May–Aug	TRP; STR	Eastern Himalaya	CUH 20258
	Dendrobium aphyllum (Roxb.) C.E.C.Fisch.	Hol	Mar–Jun	TRP; STR	SEA; NAM; NEU	CUH 20167

Family	Taxon	Life form	Phenology/ fertile period	Vegetation types	Geographic distribution	Voucher number
	Dendrobium bicameratum Lindl.	Hol	Jul–Aug	STR; STM; TMP	SEA	CUH 20120
	Dendrobium chrysanthum Wall. ex Lindl.	Hol	Jul–Nov	STR; STM; TMP	SEA; NEU	CUH 20238
	Dendrobium crepidatum Lindl. & Paxton	Hol	May–Jul	TRP; STR	SEA	CUH 20253
	Dendrobium denudans D.Don	Hol	Sep–Oct	STR; STM	SEA	CUH 20147
	Dendrobium longicornu Lindl.	Hol	Aug–Dec	STR; STM; TMP	SEA	CUH 20288
	Dendrobium moschatum (Banks) Sw.	Hol	May–Aug	STR; STM	SEA; SAM; NAM; NEU	CUH 20223
	Dendrobium nobile Lindl.	Hol	Mar–Jul	TRP; STR; STM	SEA; SAM; NAM; NEU	CUH 20211
	Dendrobium pachyphyllum (Kuntze) Bakh.f.	Hol	Mar–Jul	TRP; STR; STM	SEA	CUH 20153
	Dendrobium plicatile Lindl.	Hol	Apr–Aug	TRP; STR	SEA; EA	CUH 20184
	Dendrobium porphyrochilum Lindl.	Hol	May–Aug	STM; TMP	SEA	CUH 20305
	Dendrobium rotundatum (Lindl.) Hook.f.	Hol	Sep–Mar	STM; TMP	SEA	CUH 20297
	Dendrobium transparens Wall. ex Lindl.	Hol	Apr–May	STR; STM	SEA	CUH 20165
	Eria coronaria (Lindl.) Rchb.f.	Hol	Oct–Jun	STR; STM	SEA	CUH 20309
	Gastrochilus affinis (King & Pantl.) Schltr.	Hol	May–Jul	TMP; SAL	Indo-Bhutan; China	CUH 20289
	Gastrochilus calceolaris (Buch.-Ham. ex Sm.) D.Don	Hol	Mar–Jul	STM; TMP	SEA	CUH 20193
	Liparis resupinata Ridl.	Hol	Oct–May	STM; TMP	SEA	CUH 20323
	Liparis viridiflora (Blume) Lindl.	Hol	Oct–Feb	STM; TMP	SEA; NAM	CUH 20217
	Oberonia emarginata King & Pantl.	Hol	Sep–Nov	TMP	Indo-Bhutan; Thailand	CUH 20198
	Oberonia pachyrachis Rchb.f. ex Hook.f.	Hol	Oct–Feb	TRP; STR	SEA	CUH 20235
	Otochilus albus Lindl.	Hol	Jun–Jul	STR; STM	SEA; EA	CUH 20321
	Otochilus fuscus Lindl.	Hol	Mar–Aug	STR; STM; TMP	SEA; EA	CUH 20116
	Otochilus lancilabius Seidenf.	Hol	Oct–Apr	STR; STM; TMP	Indo-Bhutan; China	CUH 20161
	Panisea uniflora (Lindl.) Lindl.	Hol	Apr–Jun	STR; STM	SEA	CUH 20246
	Papilionanthe teres (Roxb.) Schltr	Hol	May–Jul	TRP; STR	SEA; NAM; SAM	CUH 20196
	Pinalia acervata (Lindl.) Kuntze	Hol	May–Sep	TRP; STR	SEA	CUH 20197
	Pinalia spicata (D.Don) S.C.Chen & J.J.Wood	Hol	Feb–May	STM; TMP	SEA; NAM	CUH 20218
	Pleione humilis (Sm.) D.Don	Hol	Jan–Apr	TMP	SEA	CUH 20348
	Pleione praecox (Sm.) D.Don	Hol	Sep–Dec	STM; TMP	SEA	CUH 20190
	Porpax elwesii (Rchb.f.) Rolfe	Hol	Sep–Dec	STR; STM	SEA	CUH 20160
	Porpax filiformis (Wight) Schuit., Y.P.Ng & H.A.Pedersen	Hol	Oct–Nov	STR; STM	SEA	CUH 20185
	Rhynchostylis retusa (L.) Blume	Hol	May–Sep	STR; STM	SEA; EA	CUH 20127
	Thunia alba (Lindl.) Rchb.f.	Hol	Jun–Sep	STR; STM; TMP	SEA; NAM; NEU	CUH 20128
	Uncifera obtusifolia Lindl.	Hol	Aug–Oct	STR; STM	Indo-Bhutan; Nepal	CUH 20219
	Vanda cristata Wall. ex Lindl.	Hol	Apr–Aug	STR; STM	SEA; CAM	CUH 20194
	Vandopsis undulata (Lindl.) J.J.Sm.	Hol	Apr–May	STR; STM	SEA	CUH 20216
Asparagaceae	*Maianthemum fuscum* (Wall.) LaFrankie	Acc	Jul–Oct	STM; TMP	SEA	CUH 20347
	Polygonatum brevistylum Baker	Fac	Apr–May	STM; TMP	Indo-Bhutan; Nepal	CUH 20225
	Polygonatum cathcartii Baker	Fac	May–Aug	STM; TMP	SEA	CUH 20342
	Polygonatum oppositifolium (Wall.) Royle	Fac	May–Aug	STM; TMP	SEA	CUH 20212
	Polygonatum punctatum Royle ex Kunth	Fac	Apr–May	STR; STM; TMP	SEA; NAM	CUH 20126
Commelinaceae	*Cyanotis cristata* (L.) D.Don	Acc	May–Sep	TRP; STR; STM	SEA; CAM; NEU	CUH 20178
	Floscopa scandens Lour.	Acc	Aug–Feb	TRP; STR	SEA; EA	CUH 20134
Zingiberaceae	*Cautleya spicata* (Sm.) Baker	Fac	Jun–Sep	STM; TMP	SEA; NAM	CUH 20155
	Globba clarkei Baker	Acc	May–Sep	STR; STM; TMP	SEA	CUH 20224
	Globba multiflora Wall. ex Baker	Acc	Aug–Nov	TRP; STR	SEA	CUH 20183
	Hedychium ellipticum Buch.-Ham. ex Sm.	Acc	Jun–Aug	TRP; STR; STM	SEA; CAM	CUH 20254

Family	Taxon	Life form	Phenology/ fertile period	Vegetation types	Geographic distribution	Voucher number
	Hedychium griffithianum Wall.	Acc	Jun–Sep	STR; STM; TMP	Indo–Bangladesh	CUH 20163
EUDICOTS						
Piperaceae	*Peperomia heyneana* Miq.	Hol	May–Aug	STR; STM; TMP	SEA	CUH 20201
	Peperomia pellucida (L.) Kunth	Hol	May–Sep	TRP; STR; STM	SEA; SAM; NAF; AUS	CUH 20176
	Peperomia tetraphylla (G.Forst.) Hook. & Arn.	Hol	Feb–Jul	STR; STM; TMP	SEA; SAM; SEAF	CUH 20210
	Piper attenuatum Buch.-Ham. ex Miq.	Hem	Apr–Aug	TRP; STR	SEA	CUH 20118
	Piper chuvya Hunter ex C.DC.	Hem	Nov–Dec	TRP; STR	Indo–Bhutan	CUH 20335
	Piper longum L.	Hem	Mar–Jul	TRP; STR; STM	SEA	CUH 20275
	Piper mullesua Buch.-Ham. ex D.Don	Hem	Apr–Aug	TRP; STR	SEA	CUH 20248
	Piper pedicellatum C.DC.	Hem	Feb–Jun	TRP; STR; STM	SEA	CUH 20318
	Piper peepuloides Roxb.	Hem	Aug–Oct	TRP	SEA	CUH 20251
	Piper suipigua Buch.-Ham. ex D.Don	Hem	May–Aug	STR; STM; TMP	SEA	CUH 20332
Papaveraceae	*Dactylicapnos scandens* (D.Don) Hutch.	Hem	Jun–Sep	STM; TMP	SEA; NAM; NEU	CUH 20344
Lardizabalaceae	*Holboellia angustifolia* Wall.	Acc	Apr–Jun	STM; TMP	SEA; EA	CUH 20345
Ranunculaceae	*Clematis buchananiana* DC.	Acc	Jul–Oct	STR; STM; TMP; SAL	SEA; EA	CUH 20172
Vitaceae	*Ampelocissus sikkimensis* (M.A.Lawson) Planch.	Hem	Jul–Oct	STR; STM	SEA	CUH 20135
	Cayratia pedata (Wall.) Gagnep.	Hem	Mar–Jun	STR; STM	SEA	CUH 20156
	Cissus javana DC.	Fac	Jun–Aug	TRP; STR	SEA; SAM; CAM; NEU	CUH 20159
	Tetrastigma serrulatum (Roxb.) Planch.	Hem	May–Oct	STR; STM; TMP	SEA; NEU	CUH 20226
Rosaceae	*Sorbus rhamnoides* (Decne.) Rehder	Fac	May–Jul	STM; TMP	SEA	CUH 20339
Moraceae	*Ficus sarmentosa* Buch.-Ham. ex Sm.	Hem	May–Jul	STR; STM; TMP	SEA; EA; NAM	CUH 20215
Urticaceae	*Elatostema lineolatum* Wight	Hol	May–Jun	TRP; STR	SEA; EA	CUH 20213
	Elatostema monandrum (Buch.-Ham. ex D.Don) H.Hara	Hol	May–Aug	TRP; STR; STM	SEA; Srilanka	CUH 20270
	Pilea microphylla (L.) Liebm.	Hol	Jun–Aug	TRP; STR	SEA; SAM; NAM; NEU; CAF	CUH 20182
	Pilea scripta (Buch.-Ham. ex D.Don) Wedd.	Acc	Jul–Sep	STR; STM; TMP	SEA	CUH 20154
	Pilea ternifolia Wedd.	Hol	Jun–Aug	STM; TMP	Indo–Bhutan; Nepal	CUH 20138
Cucurbitaceae	*Herpetospermum tonglense* (C.B.Clarke) H.Schaef. & S.S.Renner	Hem	Jun–Aug	STM; TMP	Indo–Nepal; China	CUH 20285
Begoniaceae	*Begonia flaviflora* Hara	Acc	July–Sep	STR; STM	SEA	CUH 20152
	Begonia hatacoa Buch.-Ham.	Acc	May–Oct	TRP; STR	SEA	CUH 20141
Celastraceae	*Euonymus viburnoides* Prain	Fac	Feb–Apr	TMP	SEA	CUH 20314
Santalaceae	*Dendrotrophe granulata* (Hook.f. & Thomson ex A.DC.) A.N.Henry & B.Roy	Hol	Apr–May	STR; STM	SEA	CUH 20125
Primulaceae	*Embelia frondosa* (King ex Gamble) D.G.Long	Fac	May–Aug	STR; STM	SEA	CUH 20244
Ericaceae	*Agapetes auriculata* (Griff.) Benth. & Hook.f.	Hol	Jun–Aug	TMP	Indo–Bhutan; Nepal	CUH 20133
	Agapetes incurvata (Griff.) Sleumer	Hol	May–Jun	STR; STM; TMP	EH; Bangladesh	CUH 20327
	Agapetes saligna (Hook.f.) Benth. & Hook.f.	Hol	Nov–May	TRP; STR; STM	SEA	CUH 20322
	Agapetes serpens (Wight) Sleumer	Fac	Feb–May	STM; TMP	EH	CUH 20319
	Agapetes smithiana Sleumer	Fac	Jun–Sep	STM; TMP	SEA	CUH 20277
	Rhododendron vaccinioides Hook.f.	Fac	Apr–Jun	TMP	SEA	CUH 20351
	Vaccinium dunalianum Wight	Hol	Feb–Apr	TMP	SEA	CUH 20333
	Vaccinium nummularia Hook.f. & Thomson ex C.B.Clarke	Hol	Apr–Aug	TMP	EH	CUH 20350
	Vaccinium retusum (Griff.) Hook.f. ex C.B.Clarke	Hol	Apr–Aug	STM; TMP	SEA	CUH 20308
	Vaccinium vacciniaceum (Roxb.) Sleumer	Hol	Mar–Aug	STM; TMP	EH	CUH 20131
Rubiaceae	*Mycetia longifolia* (Wall.) Kuntze	Fac	May–Sep	TRP; STR; STM	SEA	CUH 20298
	Neohymenopogon parasiticus (Wall.) Bennet	Hol	Jun–Aug	TRP; STR; STM	SEA	CUH 20239
Apocynaceae	*Ceropegia meyeri* Decne.	Acc	Jul–Sep	STR; STM; TMP	SEA	CUH 20320
	Dischidia bengalensis Colebr.	Fac	Jun–Sep	TRP; STR	SEA	CUH 20188
	Hoya acuta Haw.	Hol	Jul–Sep	TRP; STR	SEA	CUH 20177

Family	Taxon	Life form	Phenology/ fertile period	Vegetation types	Geographic distribution	Voucher number
	Hoya arnottiana Wight	Hol	May–Jul	TRP; STR; STM	SEA	CUH 20195
	Hoya bella Hook.	Hol	May–Aug	STR; STM	SEA	CUH 20157
	Hoya edeni King ex Hook.f.	Hol	Oct–Nov	STR; STM	SEA; NAM; NEU	CUH 20243
	Hoya fusca Wall.	Hol	Aug–Oct	STM; TMP	Indo–Bhutan; Nepal	CUH 20149
	Hoya lanceolata Wall. ex D.Don	Hol	Jul–Oct	STM; TMP	SEA; NAM; NEU	CUH 20240
	Hoya latifolia G.Don	Hol	Jul–Feb	STR; STM; TMP	SEA	CUH 20337
	Hoya linearis Wall. ex D.Don	Hol	Aug–Nov	STR; STM	SEA	CUH 20189
	Hoya longifolia Wall. ex Wight	Hol	May–Oct	TRP; STR; STM	SEA	CUH 20328
	Hoya obcordata Hook.f.	Hol	May–Jul	TRP; STR	Indo–Bhutan	CUH 20200
	Hoya polyneura Hook.f.	Hol	Feb–May	TRP; STR; STM	EH	CUH 20338
	Hoya serpens Hook.f.	Hol	May–Jun	STM; TMP	Indo–Bhutan; Nepal	CUH 20124
Gesneriaceae	*Aeschynanthus acuminatus* Wall. ex A.DC.	Hol	Jul–Oct	STM; TMP	Southeast Asia	CUH 20313
	Aeschynanthus bracteatus Wall. ex A.DC.	Hol	Jul–Oct	STR; STM; TMP	SEA	CUH 20242
	Aeschynanthus hookeri C.B.Clarke	Hol	Jul–Aug	STM; TMP	SEA	CUH 20312
	Aeschynanthus parviflorus (D.Don) Spreng.	Hol	Jul–Oct	STR; STM; TMP	SEA	CUH 20233
	Codonanthe devosiana Lem.	Hol	May–Oct	STM; TMP	SEA	CUH 20296
	Didymocarpus albicalyx C.B.Clarke	Acc	Jun–Sep	STM; TMP	EH	CUH 20168
	Didymocarpus aromaticus Wall. ex D.Don	Acc	Jul–Oct	STR; STM; TMP	SEA	CUH 20274
	Henckelia pumila (D.Don) A.Dietr.	Acc	Sep–Nov	STR; STM; TMP	SEA	CUH 20317
	Loxostigma griffithii (Wight) C.B.Clarke	Acc	Jan–Mar	TRP; STR	SEA	CUH 20334
	Lysionotus atropurpureus H.Hara	Hol	Jul–Aug	STM; TMP	Indo–Bhutan; Nepal	CUH 20276
	Lysionotus serratus D.Don	Hol	Jul–Oct	TRP; STR; STM	SEA	CUH 20158
Acanthaceae	*Thunbergia coccinea* Wall. ex D.Don	Hem	Jul–Nov	STR; STM; TMP	SEA	CUH 20142
	Thunbergia lutea T.Anderson	Acc	Jul–Oct	STM; TMP	SEA	CUH 20146
Lamiaceae	*Premna corymbosa* Rottler & Willd.	Hem	May–Jul	STM; TMP	SEA	CUH 20173
	Premna interrupta Wall. ex Schauer	Hem	May–Jul	TRP; STR	SEA; SAF	CUH 20324
Asteraceae	*Senecio buimalia* Buch.-Ham. ex D.Don	Acc	Aug–Dec	STR; STM; TMP; SAL	EH	CUH 20136
Pittosporaceae	*Pittosporum napaulense* (DC.) Rehder & Wilson	Acc	May–Aug	STM; TMP	SEA	CUH 20299
Araliaceae	*Aralia leschenaultii* (DC.) J.Wen	Acc	Apr–Jul	STM; TMP; SAL	SEA	CUH 20282
FERNS AND LYCOPHYTES						
Lycopodiaceae	*Huperzia hamiltonii* (Spreng.) Trevis.	Hol	Jul–Oct	STM; TMP	SEA	CUH 20286
	Huperzia phlegmaria (L.) Rothm.	Hol	Jun–Sep	STR; STM	SEA; NAM	CUH 20234
	Huperzia pulcherrima (Wall. ex Hook. & Grev.) Pic.Serm.	Hol	Jul–Oct	STR; STM	SEA	CUH 20148
	Huperzia squarrosa (G.Forst.) Trevis.	Hol	Jul–Oct	STM; TMP	Indo–Nepal	CUH 20199
Hymenophyl-laceae	*Hymenophyllum badium* Hook. & Grev.	Hol	Aug–Nov	STR; STM; TMP	SEA	CUH 20284
	Hymenophyllum exsertum Wall. ex Hook.	Hol	Aug–Nov	TMP	SEA; EA	CUH 20186
	Hymenophyllum simonsianum Hook.	Hol	Aug–Nov	STR; STM	SEA	CUH 20307
	Hymenophyllum tenellum D.Don	Hol	Aug–Nov	STR; STM	SEA; EA	CUH 20271
Pteridaceae	*Antrophyum coriaceum* (D.Don) Wall. ex T. Moore	Hol	Aug–Dec	STR; STM	Indo–Nepal; China	CUH 20179
	Vittaria elongata Sw.	Hol	Jul–Oct	STR; STM; TMP	SEA; SAF	CUH 20303
	Vittaria flexuosa Fee	Hol	Jul–Oct	STM; TMP	SEA; EA	CUH 20150
	Vittaria himalayensis Ching	Hol	Jul–Oct	STM; TMP	SEA	CUH 20241
	Vittaria ophiopogonoides Ching	Hol	Jul–Oct	TRP; STR	SEA	CUH 20202
	Vittaria sikkimensis Kuhn	Hol	Aug–Nov	STR; STM; TMP	Indo–China	CUH 20310
Aspleniaceae	*Asplenium ensiforme* Wall. ex Hook. & Grev.	Hol	Jun–Sep	STM; TMP	EH; EA	CUH 20329
	Asplenium laciniatum D.Don	Hol	Jul–Dec	STR; STM	SEA	CUH 20227
	Asplenium nidus L.	Fac	Jun–Nov	STR; STM; TMP	SEA; SAF	CUH 20123
	Asplenium phyllitidis D.Don	Fac	Aug–Oct	STR; STM; TMP	Indo–China; CAM	CUH 20174
	Asplenium planicaule Wall. ex Mett.	Fac	Aug–Nov	STR; STM; TMP	SEA; SAF	CUH 20266

Family	Taxon	Life form	Phenology/ fertile period	Vegetation types	Geographic distribution	Voucher number
	Asplenium tenuifolium D.Don	Fac	Aug–Dec	STR; STM; TMP	SEA	CUH 20268
	Asplenium yoshinagae Makino	Fac	Jun–Nov	TRP; STR	SEA; SAM; NAM; NEU; CAF	CUH 20121
Hypodematiaceae	*Leucostegia truncata* (D.Don) Fraser-Jenk.	Hol	Jul–Sep	STR; STM	SEA	CUH 20206
Dryopteridaceae	*Elaphoglossum marginatum* T.Moore	Hol	May–Jul	STR; STM; TMP	SEA	CUH 20293
	Elaphoglossum stelligerum (Wall. ex Baker) T.Moore ex Salomon	Acc	Jul–Oct	STR; STM	SEA	CUH 20137
Nephrolepidaceae	*Nephrolepis cordifolia* (L.) C.Presl	Fac	Aug–Nov	STR; STM; TMP	SEA; SAM; NAM; NEU; CAF	CUH 20122
Oleandraceae	*Oleandra pistillaris* (Sw.) C.Chr.	Fac	Aug–Oct	STR; STM	SEA	CUH 20228
	Oleandra wallichii (Hook.) C.Presl	Fac	Aug–Oct	STR; STM; TMP	SEA	CUH 20273
Davalliaceae	*Araiostegia dareiformis* (Hook.) Copel.	Fac	Jul–Oct	TMP	Indo–Nepal; Thailand	CUH 20119
	Araiostegia multidentata (Wall. ex Hook.) Copel.	Hol	Jul–Dec	STM; TMP	Indo–Nepal	CUH 20129
	Davallia bullata Wall.	Fac	Jul–Oct	STR; STM	EH; EA	CUH 20231
	Davallia pulchra D.Don	Fac	Jul–Nov	STM; TMP	SEA	CUH 20139
Polypodiaceae	*Arthromeris himalovata* Fraser-Jenk. & Kandel	Hol	Jun–Nov	TMP	SEA	CUH 20346
	Arthromeris lehmannii (Mett.) Ching	Hol	Jun–Nov	TMP	SEA	CUH 20291
	Arthromeris wallichiana (Spreng.) Ching	Hol	Aug–Dec	STM; TMP	SEA	CUH 20295
	Drynaria mollis Bedd.	Hol	Jun–Aug	STM; TMP	EH	CUH 20263
	Drynaria propinqua (Wall. ex Mett.) J.Sm.	Hol	May–Oct	STM; TMP	SEA	CUH 20205
	Drynaria quercifolia (L.) J.Sm.	Hol	Jul–Dec	TRP; STR	SEA	CUH 20175
	Goniophlebium amoenum (Wall. ex Mett.) Bedd.	Hol	Aug–Nov	STM; TMP	SEA	CUH 20230
	Goniophlebium argutum (Wall. ex Hook.) Bedd.	Hol	Sep–Nov	STR; STM; TMP	SEA	CUH 20229
	Goniophlebium hendersonii (Atk.) Bedd.	Hol	Jul–Sep	TMP	SEA	CUH 20292
	Goniophlebium lachnopum (Wall. ex Hook.) Bedd.	Hol	Jun–Oct	STM; TMP	SEA	CUH 20203
	Goniophlebium microrhizoma (C.B. Clarke ex Baker) Clarke ex Bedd.	Hol	Jul–Oct	STM; TMP	SEA	CUH 20143
	Goniophlebium subamoenum (C.B. Clarke) Bedd.	Fac	Jun–Nov	STR; STM; TMP	Indo–China; Nepal	CUH 20144
	Lemmaphyllum rostratum (Bedd.) Tagawa	Hol	Mar–Jul	TMP	SEA	CUH 20316
	Lepisorus contortus Ching	Hol	Aug–Nov	STM; TMP	SEA	CUH 20113
	Lepisorus loriformis Ching	Hol	Jul–Sep	TMP	SEA	CUH 20283
	Lepisorus mehrae Fraser-Jenk.	Hol	Jul–Nov	STM; TMP	EH	CUH 20115
	Lepisorus normalis (D.Don) C.F.Zhao, R.Wei & X.C.Zhang	Hol	Aug–Nov	STR; STM; TMP	SEA	CUH 20340
	Lepisorus nudus Ching	Hol	Oct–Feb	STM; TMP	SEA	CUH 20180
	Lepisorus scolopendrium (Ching) Mehra & Bir	Hol	Jul–Sep	STM; TMP	SEA	CUH 20117
	Lepisorus sordidus (C.Chr.) Ching	Hol	Jul–Sep	STR; STM; TMP	EH	CUH 20220
	Lepisorus sublinearis Ching	Hol	Jul–Sep	TMP	SEA	CUH 20269
	Loxogramme chinensis Ching	Hol	Sep–Nov	STR; STM	SEA	CUH 20145
	Loxogramme cuspidata (Zenker) M.G.Price	Hol	Jun–Sep	STR; STM; TMP	SEA	CUH 20279
	Loxogramme grammitoides (Baker) C. Chr.	Hol	Jul–Nov	STR; STM	SEA	CUH 20330
	Loxogramme involuta (D.Don) C.Presl	Hol	Aug–Oct	STR; STM; TMP	SEA	CUH 20336
	Loxogramme lanceolata (Sw.) C. Presl	Hol	Aug–Dec	STM; TMP	SEA	CUH 20204
	Loxogramme porcata M.G.Price	Hol	Aug–Nov	STR; STM	EH	CUH 20262
	Microsorum cuspidatum (D.Don) Tagawa	Fac	Aug–Dec	STR; STM	SEA	CUH 20278
	Microsorum membranaceum (D.Don) Ching	Fac	Aug–Dec	STR; STM; TMP	SEA	CUH 20272
	Microsorum punctatum (L.) Copel.	Fac	Aug–Nov	TRP; STR	SEA; SAF; CAM	CUH 20260
	Pyrrosia costata (Wall. ex C.Presl) Tagawa & K.Iwats.	Hol	Jul–Sep	TRP; STR	SEA	CUH 20209
	Pyrrosia heteractis (Mett. ex Kuhn) Ching	Fac	Jul–Oct	STR; STM; TMP	SEA	CUH 20140
	Pyrrosia lanceolata (L.) Farw.	Hol	Jul–Dec	TRP; STR	SEA; NAM	CUH 20249
	Pyrrosia mannii (Giesenh.) Ching	Hol	Jul–Oct	TRP; STR; STM	SEA	CUH 20214
	Pyrrosia nuda (Giesenh.) Ching	Hol	Jul–Oct	TRP; STR	SEA	CUH 20264
	Pyrrosia porosa (C.Presl) Hovenkamp	Hol	Jul–Oct	STR; STM	SEA	CUH 20331

Family	Taxon	Life form	Phenology/ fertile period	Vegetation types	Geographic distribution	Voucher number
	Selliguea ebenipes (Hook.) S.Linds.	Hol	Jul–oct	STM; TMP	EH	CUH 20207
	Selliguea griffithiana (Hook.) Fraser-Jenk.	Hol	May–Oct	STM; TMP	SEA	CUH 20326
	Selliguea hastata (Thunb.) Fraser-Jenk.	Hol	Jun–Nov	TMP	SEA; EA	CUH 20267
	Selliguea oxyloba (Wall. ex Kunze) Fraser-Jenk.	Hol	Jun–Sep	STM; TMP	SEA	CUH 20151
	Selliguea stewartii (Bedd.) S.G.Lu, Hovenkamp & M.G.Gilbert	Hol	Jun–Oct	TMP	Indo–China; Nepal	CUH 20294
	Tomophyllum donianum (Spreng.) Fraser-Jenk. & Parris	Hol	Aug–Nov	STR; STM; TMP	SEA	CUH 20257

connection with the ground) (Klein et al. 2022).

Results

We documented 239 species of vascular epiphytes belonging to 93 genera and 38 families (Table 1). Epiphytic angiosperms represented 70% of the species richness (166 spp.), while the remaining species (30%; 72 spp.) were epiphytic ferns. Monocotyledons were the most diverse group (92 spp.) compared to dicotyledons (74 spp.). Based on the life forms, holoepiphytes (160 spp.) were dominant representing 67% of the total species, of which orchids were dominant. Hemiepiphytes (22 spp.) accounted for 22% of the total species, with the family Piperaceae predominant. The other life forms were facultative (31 spp.) and accidental (25 spp.) representing 13% and 11% of the total species, respectively (Fig. 2A).

Of the total 38 families, Orchidaceae was the largest family, with 70 epiphytic species in 22 genera and representing 29% of all species (Fig. 2B). Among these, there were large genera such as *Bulbophyllum* Thouars (with 15 spp.), *Dendrobium* Sw. (14 spp.), *Coelogyne* Lindl. (7 spp.), and *Cymbidium* Sw. (6 spp.). Within the family Orchidaceae, there was only one species that grew as either an epiphyte or a lithophyte (e.g., *Coelogyne cristata* Lindl.). Another most important family in terms of epiphytic species was the fern family Polypodiaceae, with 42 epiphytes in 10 genera and representing 17% of all species. *Lepisorus* (J.Sm.) Ching (8 spp.) was the most species-rich genus, followed by *Goniophlebium* (Blume) C.Presl and *Loxogramme* (Blume) C.Presl with six species in each genus. Another family with high number of species was Apocynaceae. Approximately, 15 species were epiphytic, with *Hoya* R.Br. (12 spp.) having the most species. Almost all the species in the Apocynaceae were holoepiphytes in growth form, except for *Dischidia bengalensis* Colebr., which was facultative. A large proportion of species in the Ericaceae (10 spp.) were found on both trees and rocks. Species of *Agapetes* D.Don ex G.Don and *Vaccinium* L. in the Ericaceae were common. The 11 epiphytic species of Gesneriaceae, especially in *Aeschynanthus* Jack and *Lysionotus* D.Don, are almost entirely holoepiphytes, whereas species like *Didymocarpus albicalyx* C.B.Clarke, *D. aromaticus* Wall. ex D.Don, and *Henckelia pumila* (D.Don) A.Dietr. were accidental epiphytes.

Slightly fewer species were found within families like Acanthaceae, Commelinaceae, Oleandraceae and Rubiaceae with only two species under each, while the least abundant families were Araliaceae, Asteraceae, Nephrolepidaceae and Rosaceae each with single species. Almost all members of Araceae were either hemiepiphytes or grow facultatively or accidentally as epiphytes. Similarly, two species of Dioscoreaceae namely *Dioscorea belophylla* (Prain) Voigt ex Haines and *D. bulbifera* L. were found to be accidental epiphytes. Most of the species listed in Table 1 representing eight families Araliaceae, Asteraceae, Commelinaceae, Pittosporaceae, Ranunculaceae, Lardizabalaceae, and Zingiberaceae were not true epiphytes, but accidental or facultative (Figs. 5–7).

The second most important epiphytic families in terms of species number were the fern families Pteridaceae and Aspleniaceae each with seven species. *Vittaria* J.E.Sm. and *Asplenium* L. were the most dominant genera. Some members of Aspleniaceae, like *Asplenium*

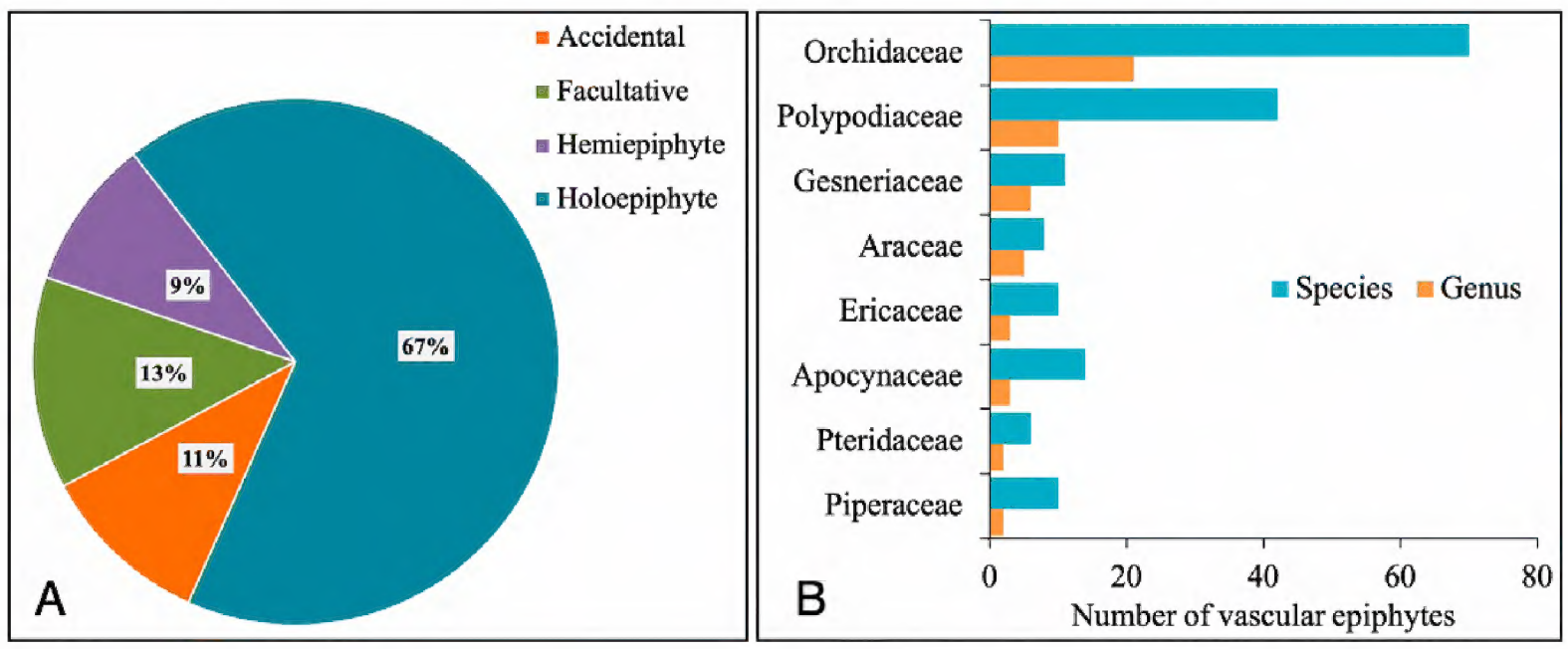

Figure 2. A. Life forms of vascular epiphytes. **B.** Dominant families showing number of species and genus.

Figure 3. Vegetation types of Darjeeling Himalaya. **A–C.** Tropical (TRP). **D–F.** Subtropical (STR). **G–I.** Subtemperate (STM). **J–L.** Temperate (TMP). **M–N.** Subalpine (SAL).

falcatum Lam., *A. planicaule* Wall. ex Mett., *A. laciniatum* D.Don, *A. tenuifolium* D.Don, and *A. nidus* L., were facultatively epiphytic. Oleandraceae are mostly lithophytes, but two species, *Oleandra pistillaris* (Sw.) C.Chr. and *O. wallichii* (Hook.) C.Presl, occasionally grew on the lower tree trunks. *Elaphoglossum stelligerum* (Wall. ex Baker) T.Moore ex Salomon, belonging to Dryopteridaceae, was found to be growing accidentally as an epiphyte.

Distribution and composition in vegetation types. The number and percentage in the Venn diagram depict the unique and shared number of monocots (Fig. 4A), eudicots (Fig. 4B), and ferns and lycophytes (Fig.

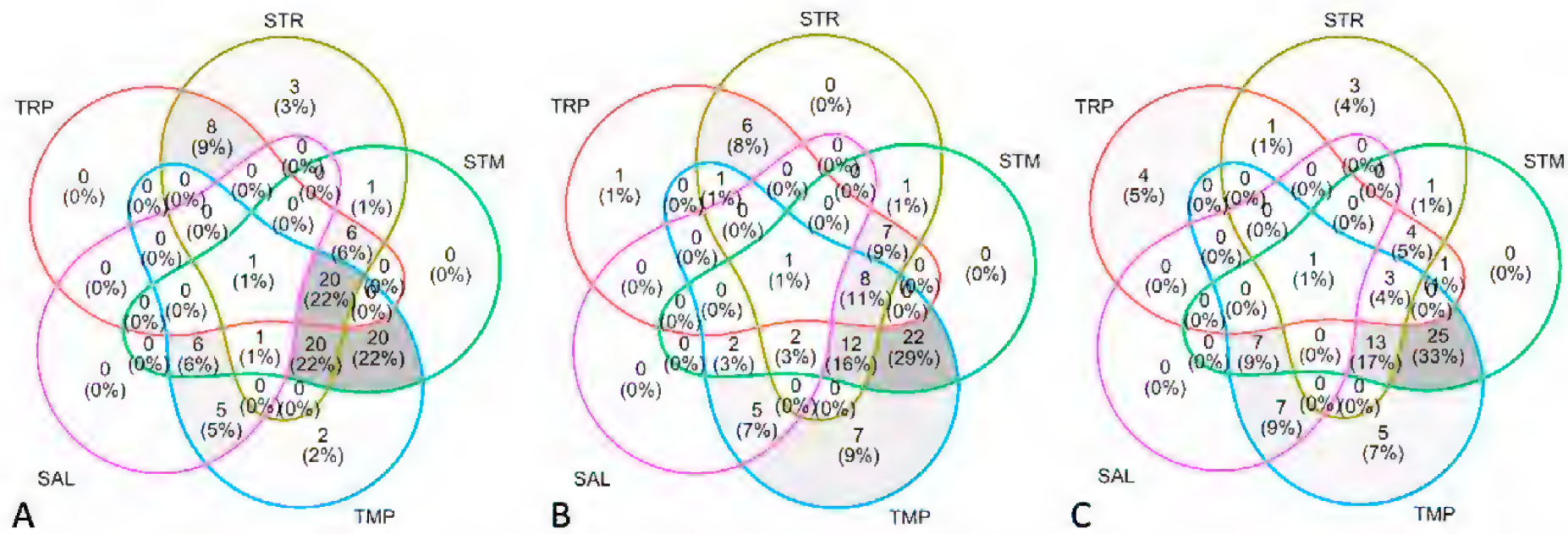

Figure 4. Venn diagram showing unique and shared number of vascular epiphytes in five vegetation types. **A.** Monocots. **B.** Eudicots. **C.** Ferns and lycophytes.

4C) in different types of vegetation. The highest percentage of similarity in the composition of epiphytic monocots, eudicots, and ferns and lycophytes were 22%, 29%, and 33%, respectively. Among the different vegetation types, STR, STM, and TMP comprise almost the same vascular epiphytic species, whereas TRP and SAL did not share single species. The composition of the vascular epiphytes in the different vegetation types is given below.

Tropical vegetation (TRP)

Figure 3A–C

Within the tropical vegetation, vascular epiphytes were established on some common phorophytes *Callicarpa vestita* Wall. ex C.B.Clarke, *Lagerstroemia parviflora* Roxb., *Duabanga grandiflora* Walp., *Shorea robusta* Gaertn., *Tetrameles nudiflora* R.Br. and *Mallotus repandus* (Rottler) Mull.Arg. Some orchids like *Papilionanthe teres* (Roxb.) Schltr, *Dendrobium amoenum* Wall. ex Lindl. and *Panisea uniflora* (Lindl.) Lindl. was most common in this zone. Some ferns were frequent, especially *Asplenium falcatum* Lam., *Drynaria quercifolia* (L.) J.Sm., *Loxogramme porcata* M.G.Price, *Microsorum punctatum* (L.) Copel. Species like *Scindapsus officinalis* (Roxb.) Schott and *Hoya acuta* Haw. were observed only in this vegetation type.

Subtropical vegetation (STR)

Figure 3D–F

The vegetation zone was dominated by host trees like *Bridelia retusa* (L.) A.Juss, *Sterculia villosa* Roxb. ex Sm., *Ostodes paniculata* Blume, *Terminalia bellirica* (Gaertn.) Roxb., *Diploknema butyracea* (Roxb.) H.J.Lam, *Wrightia sikkimensis* Gamble, and *Senna siamea* (Lam.) H.S.Irwin & Barneby. Among the recorded species, frequent epiphytic orchids were *Aerides multiflora* Roxb., *Acampe rigida* (Buch.-Ham. ex Sm.) P.F.Hunt, *Bulbophyllum crassipes* Hook.f., *Dendrobium plicatile* Lindl., and *Cymbidium bicolor* Lindl. Species of Araceae, like *Rhaphidophora hookeri* Schott and *R. decursiva* (Roxb.) Schott, were most common, as were the ferns *Pyrrosia costata* (Wall. ex C.Presl) Tagawa & K.Iwats. and *P. mannii* (Giesenh.) Ching.

Subtemperate vegetation (STM)

Figure 3G–I

The main host tree species were *Ficus auriculata* Lour., *F. neriifolia* Sm., *Engelhardia spicata* Lechen ex Blume, *Macaranga denticulata* (Blume) Mull. Arg., *Cryptomeria japonica* (Thunb. ex Life), and *Schima wallichii* (DC.) Korth. The most common epiphytes in this area were *Bulbophyllum affine* Wall. ex Lindl., *Uncifera obtusifolia* Lindl., *Cymbidium eburneum* Lindl., *Hoya arnottiana* Wight, *H. obcordata* Hook.f., and *H. lanceolata* subsp. *bella* (Hook.) D.H.Kent. Some epiphytic ferns were frequent, especially *Microsorum cuspidatum* (D.Don) Tagawa, *Huperzia squarrosa* (G.Forst.) Trevis., *Hymenophyllum tenellum* D.Don, and *Davallia bullata* Wall.

Temperate vegetation (TMP)

Figure 3J–L

In this vegetation zone, the highest density of vascular epiphytes was observed especially on *Alnus nepalensis* D.Don, *Exbucklandia populnea* (R.Br. ex Griff.) R.W. Br., *Magnolia campbellii* Hook.f. & Thom., *Quercus lamellosa* Sm., *Rhododendron falconeri* Hook.f., *Tsuga dumosa* (D. Don) Eichler, and *Acer campbellii* Hook.f. & Thom. ex Hiern. Species of *Aeschynanthus* Jack, *Agapetes* D.Don ex G.Don, *Bulbophyllum* Thouars, *Coelogyne* Lindl. *Lepisorus* (J.Sm.) Ching, *Hoya* R.Br., and *Selliguea* Bory were most abundant and diverse in this zone.

Subalpine vegetation (SAL)

Figure 3M–O

In this zone, structural variation of the host tree was very low due to varied topography and extreme climate, which reduces available microhabitats for epiphytes. Species like *Arthromeris himalovata* Fraser-Jenk. & Kandel, *Huperzia hamiltonii* (Spreng.) Trevis., *Senecio buimalia* Buch.-Ham. ex D.Don, *Coelogyne occultata* Hook.f., and *Pleione humilis* (Sm.) D.Don were observed as epiphytes, while the dominant host trees encountered were *Abies densa* Griff., *Lyonia ovalifolia*

(Wall.) Drude, *R. hodgsonii* Hook.f., *R. fulgens* Hook.f., *R. campylocarpum* Hook.f., *Tsuga dumosa* (D.Don) Eichler, and *R. falconeri* Hook.f.

Annotated list. The materials examined for all the vascular epiphytes recorded in the study area are given below, including brief information on taxonomic, ecological, phenological, and global distribution for the 25% of the total species recorded.

Piperaceae Giseke

***Peperomia heyneana* Miq.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 29.VIII.2020; Rai & Moktan 0318 leg.; CUH 20201.

***Peperomia pellucida* (L.) Kunth**
Figure 6I

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 29.VIII.2019; Rai & Moktan 0233 leg.; CUH 20176.

Identification. Holoepiphyte. Plant creeping or erect herb, glabrous throughout, 15.5–38.5 cm. Leaves thin, 2–3 × 1–2.5 cm, broadly ovate, apex acute, base cordate, 5-veined from base. Inflorescence spikes, terminal, 3.5–5 cm.

Global distribution. India, Bhutan, China, Indonesia, Malaysia, Philippines, Thailand, Vietnam (POWO 2022).

Ecology. Common in TRP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from May to September.

***Peperomia tetraphylla* (G.Forst.) Hook. & Arn.**
Figure 7H

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 03.IX.2020; Rai & Moktan 0348 leg.; CUH 20210.

Identification. Holoepiphyte. Plants forming clumps, 5.5–18.5 cm, stolon present. Stems many-branched at the base, ribbed, glabrous or pubescent. Leaves dense opposite or whorl of 4 fleshy obovate, uniform in size 6.0–11.5 × 5.5–10.0 mm leaf blade broadly elliptical to suborbicular, base and apex rounded, 3-veined from the base. Petiole 0.9–2.0 mm pubescent. Inflorescence spikes, terminal and axillary, 1.5–5.0 cm. Filaments short, ovary ovoid, stigma capitates, pubescent. Fruit drupe, ellipsoid, tapering apex.

Global distribution. Southeast Asia, Central America, South America, South Africa, Australia (POWO 2022).

Ecology. Common in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from February to July.

***Piper attenuatum* Buch.-Ham. ex Miq.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 15.III.2019; Rai & Moktan 0008 leg.; CUH 20118.

***Piper chuvya* Hunter ex C.DC.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 12.VI.2021; Rai & Moktan 0592 leg.; CUH 20335.

***Piper longum* L.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rungbull; 26°59′19″N, 088° 16′18″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0481 leg.; CUH 20275.

***Piper mullesua* Buch.-Ham. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 20.IX.2020; Rai & Moktan 0408 leg.; CUH 20248.

***Piper pedicellatum* C.DC.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 27°00′16″N, 088°15′ 36″E; alt. 2200 m; 04.IV.2021; Rai & Moktan 0556 leg.; CUH 20248.

***Piper peepuloides* Roxb.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088° 14′25″E; alt. 400 m; 20.IX.2020; Rai & Moktan 0413 leg.; CUH 20251.

***Piper suipigua* Buch.-Ham. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Babukhola; 26°55′03″N, 088° 20′27″E; alt. 1900 m; 05.V.2021; Rai & Moktan 0577 leg.; CUH 20332.

Araceae Juss.

***Colocasia affinis* Schott**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Tindharia; 26°51′11″N, 088° 19′59″E; alt. 860 m; 24.VIII.2019; Rai & Moktan 0206 leg.; CUH 20332.

***Pothos scandens* L.**

Material examined. INDIA – Eastern Himalaya •

Figure 5. Epiphytic orchids. **A.** *Dendrobium porphyrochilum*. **B.** *Dendrobium rotundatum*. **C.** *Otochilus albus*. **D.** *Pleione humilis*. **E.** *Bulbophyllum leopardinum*. **F.** *Pleione praecox*. **G.** *Bulbophyllum crassipes*. **H.** *Bulbophyllum odoratissimum*. **I.** *Cymbidium hookerianum*. **J.** *Liparis resupinata*. **K.** *Coelogyne cristata*. **L.** *Dendrobium chrysanthum*.

West Bengal, Darjeeling, Lower Mamring; 26°56′34″N, 088°19′52″E; alt. 1400 m; 20.IX.2020; Rai & Moktan 0416 leg.; CUH 20252.

Remusatia pumila **(D.Don) H.Li & A.Hay**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 11.IV.2021; Rai & Moktan 0566 leg.; CUH 20325.

Rhaphidophora calophylla **Schott**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 30.VIII.2019; Rai & Moktan 0240 leg.; CUH 20181.

Rhaphidophora decursiva **(Roxb.) Schott**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 27.IX.2020; Rai & Moktan 0451 leg.; CUH 20265.

Figure 6. Epiphytic angiosperms. **A.** *Coelogyne punctulata*. **B.** *Cymbidium elegans*. **C.** *Rhynchostylis retusa*. **D.** *Vanda cristata*. **E.** *Dendrobium nobile*. **F.** *Bulbophyllum reptans*. **G.** *Dendrobium longicornu*. **H.** *Cymbidium aloifolium*. **I.** *Peperomia pellucida*. **J.** *Rhaphidophora glauca*. **K.** *Agapetes smithiana*. **L.** *Cautleya spicata*.

***Rhaphidophora glauca* (Wall.) Schott**
Figure 6J

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°56′34″N, 088°19′52″E; alt. 1400 m; 26.IX.2020; Rai & Moktan 0432 leg.; CUH 20261.

Identification. Hemiepiphytes. Stem 0.5–1.0 cm in diameter. Leaf blade ovate in outline, symmetric, acuminate, base truncate, oblique or shallowly cordate 10.5–35.0 × 6.5–22.0 cm, irregularly and asymmetrically pinnately cut, leaflet 2–5 per side, petiole 8–34 cm, sheath at leaf base, pulvinus indistinct. Peduncle long, thin, apex curved, 9.5–23.0 cm. Spathe oblong-ovate, acuminate, pale yellow, 7.5–13.0 × 2.0–8.0 cm. Spadix 5.0–9.0 × 0.6–1.5 cm. Filament flat. Stigma flat, sessile, circular or elliptical.

Global distribution. India, Bangladesh, Laos, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STM and TMP and usually found in the trunk zone.

Phenology. Flowering and fruiting period from September to May.

***Rhaphidophora hookeri* Schott**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1100 m; 03.VII.2019; Rai & Moktan 0081 leg.; CUH 20132.

Figure 7. Epiphytic angiosperms. **A.** *Agapetes serpens*. **B.** *Vaccinium nummularia*. **C.** *Hoya fusca*. **D.** *Vaccinium vacciniaceum*. **E.** *Aeschynanthus bracteatus*. **F.** *Polygonatum oppositifolium*. **G.** *Lysionotus serratus*. **H.** *Peperomia tetraphylla*. **I.** *Aeschynanthus parviflorus*. **J.** *Hoya bella*. **K.** *Dactylicapnos scandens*. **L.** *Vaccinium retusum*.

***Scindapsus officinalis* (Roxb.) Schott**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088° 14′25″E; alt. 400 m; 23.IX.2020; Rai & Moktan 0430 leg.; CUH 20259.

Dioscoreaceae R.Br.

***Dioscorea belophylla* (Prain) Voigt ex Haines**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0368 leg.; CUH 20222.

***Dioscorea bulbifera* L.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, One Block; 26°56′22″N, 088° 19′04″E; alt. 1900 m; 09.IV.2021; Rai & Moktan 0547 leg.; CUH 20311.

Orchidaceae Juss.

***Acampe rigida* (Buch.-Ham. ex Sm.) P. f.Hunt**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 24.VIII.2019; Rai & Moktan 0224 leg.; CUH 20311.

***Aerides multiflora* Roxb.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sukna; 26°47′00″N, 088°

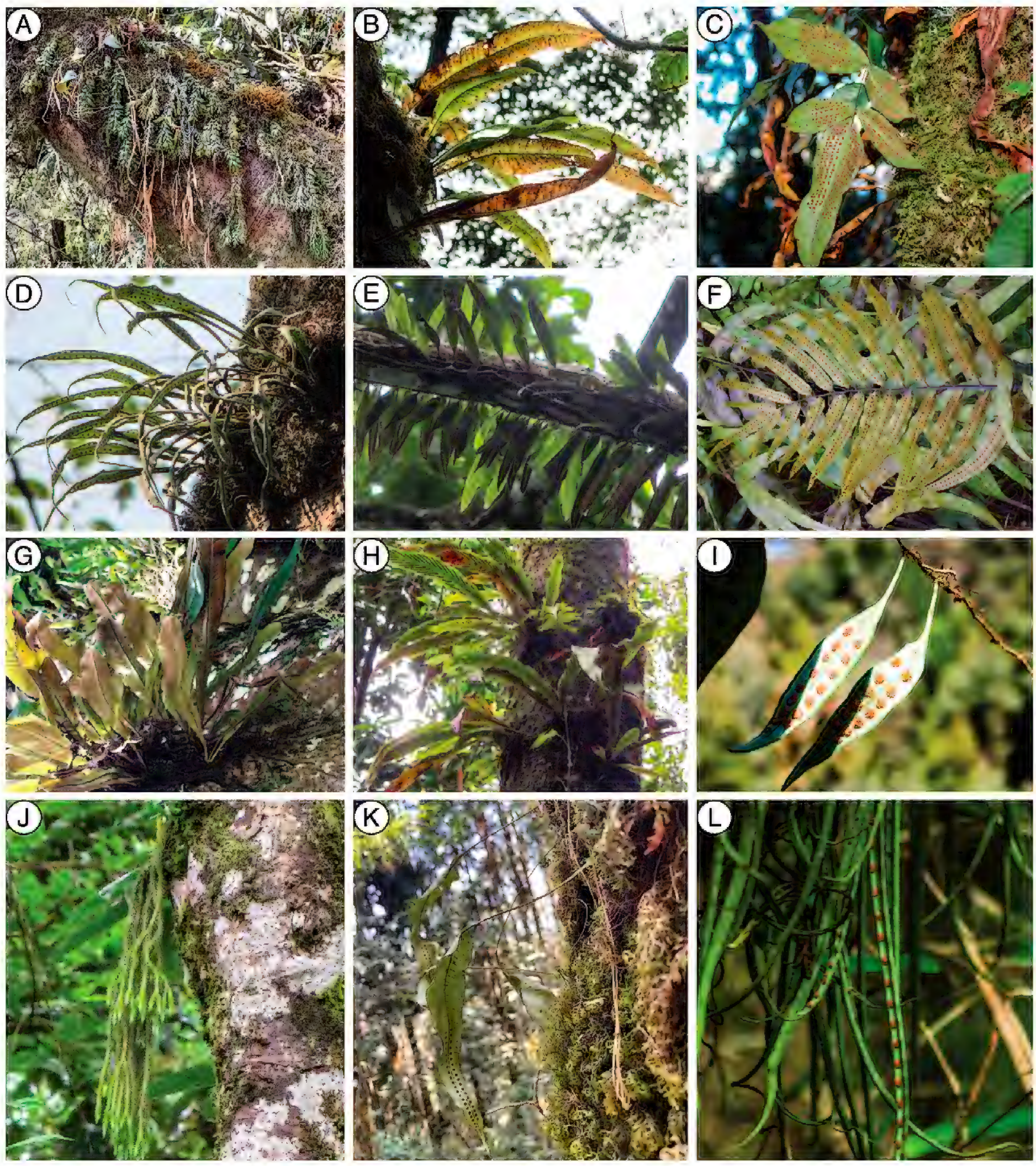

Figure 8. Epiphytic ferns. **A.** *Huperzia hamiltonii*.**B.** *Microsorum membranaceum*. **C.** *Arthromeris himalovata*.**D.** *Lepisorus contortus*. **E.** *Pyrrosia lanceolata*. **F.** *Microsorum cuspidatum*. **G.** *Pyrrosia costata*. **H.** *Loxogramme involuta*. **I.** *Lemmaphyllum rostratum*. **J.** *Huperzia pulcherrima*. **K.** *Selliguea griffithiana*. **L.** *Lepisorus loriformis*.

14′25″E; alt. 400 m; 24.VIII.2019; Rai & Moktan 0223 leg.; CUH 20169.

***Agrostophyllum myrianthum* King & Pantl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088° 18′59″E; alt. 1700 m; 06.IV.2021; Rai & Moktan 0542 leg.; CUH 20306.

***Agrostophyllum planicaule* (Wall. ex Lindl.) Rchb. f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 28.VIII.2019; Rai & Moktan 0226 leg.; CUH 20306.

***Agrostophyllum stipulatum* subsp. bicuspidatum (J.J.Sm.) Schuit.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0396 leg.; CUH 20306.

***Bulbophyllum affine* Wall. ex Lindl.**

Material examined. INDIA – Eastern Himalaya •

Figure 9. Epiphytic ferns. **A.** *Lepisorus mehrae*.**B.** *Pyrrosia mannii*. **C.** *Asplenium yoshinagae*. **D.** *Leucostegia truncata*. **E.** *Oleandra pistillaris*. **F.** *Arthromeris wallichiana*.**G.** *Pyrrosia heteractis*. **H.** *Elaphoglossum stelligerum*. **I.** *Asplenium ensiforme*. **J.** *Goniophlebium amoenum*. **K.** *Nephrolepis cordifolia*. **L.** *Vittaria flexuosa*.

West Bengal, Darjeeling, Rungbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 30.X.2020; Rai & Moktan 0489 leg.; CUH 20306.

Bulbophyllum appendiculatum **(Rolfe) J.J.Sm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′ 06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0502 leg.; CUH 20290.

Bulbophyllum careyanum **(Hook.) Spreng**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 02.XI.2020; Rai & Moktan 0411 leg.; CUH 20250.

Bulbophyllum cauliflorum **Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 09.IV.2021; Rai & Moktan 0553 leg.; CUH 20315.

Bulbophyllum crassipes **Hook.f.**

Figure 5G

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 02.IX.2019; Rai & Moktan 0270 leg.; CUH 20191.

Identification. Holoepiphyte. Rhizome thick. Pseudobulbs conical, 4.5–3.5 cm, covered with swollen sheaths, 0.5–1.0 mm thick. Leaf oblong, obtuse to mucronate, 6.0–13.5 × 1.0–3.5 cm. Inflorescence racemose, lateral from pseudobulb base, many-flowered, peduncle thick, short, flower 0.8 cm long, greenish to golden spotted with purple, calyx obovate to elliptical acute, corolla narrowly elliptical acute. Lip simple, yellowish gold or purplish red, column slender, white, stelidia short and triangular.

Global distribution. India, Bhutan, Bangladesh, south-central China, Laos, Malaya, Myanmar, Thailand, Vietnam (POWO 2022).

Ecology. Common in TRP, STR, and STM and usually found in the trunk zone.

Phenology. Flowering and fruiting period from September to December.

***Bulbophyllum gamblei* Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0366 leg.; CUH 20221.

***Bulbophyllum helenae* (Kuntze) J.J.Sm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′ 57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0602 leg.; CUH 20343.

***Bulbophyllum hirtum* (Sm.) Lindl. ex Wall.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′ 06″E; alt. 2510 m; 05.IV.2020; Rai & Moktan 0527 leg.; CUH 20302.

***Bulbophyllum leopardinum* (Wall.) Lindl. ex Wall.**
Figure 5E

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′ 57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0600 leg.; CUH 20341.

Identification. Holoepiphyte. Plant 10.0–26.7 cm tall. Pseudobulbs cylindric, clustered. Leaf single, 7.5–18.0 × 3.5–6.5 cm, oblong-elliptical, petiolate, mucronate. Inflorescence short, 1- to 5-flowered. Flower pinkish yellow, spotted with purple, 2.0–1.5 cm, floral bract ovate, dorsal sepal ovate-lanceolate, acute, lateral sepal acuminate, obliquely ovate. Lip 1.5–1.7 × 0.5–0.8 cm, pale white suffused with scarlet red, decurved. Column thick with curved foot. Anther conical. Pollinia 4.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand (POWO 2022).

Ecology. Less frequent in STM and TMP and usually found on the trunk zone.

Phenology. Flowering and fruiting period from June to November.

***Bulbophyllum melanoglossum* Hayata**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 26°58′50″N, 088° 13′48″E; alt. 2200 m; 22.IX.2020; Rai & Moktan 0425 leg.; CUH 20256.

***Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall.**
Figure 5H

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 02.IX.2020; Rai & Moktan 0331 leg.; CUH 20208.

Identification. Holoepiphyte. Plant creeping, slender rhizome. Pseudobulbs cylindric, erect, smooth, 1.8–2.5 × 0.2–0.7 cm. Leaf 1, oblong-elliptical to oblong-lanceolate, petiolate, 6–10 × 1–2 cm. Inflorescence 1- or 2-capitate, basal from pseudobulb base, many-flowered, flowers 0.5–1.0 cm, white tipped with yellow. Lip white to pale orange, calyx lanceolate, acuminate, column yellow, ovate, obtuse, column stout, foot short. Anther ovate, pollinia yellowish.

Global distribution. India, Bhutan, China, Laos, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STM and TMP and usually found in the trunk zone.

Phenology. Flowering and fruiting period from July to October.

***Bulbophyllum reptans* (Lindl.) Lindl. ex Wall.**
Figure 6F

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gairibans; 27°02′53″N, 088° 01′48″E; alt. 2600 m; 05.V.2021; Rai & Moktan 0531 leg.; CUH 20304.

Identification. Holoepiphyte. Plant with slender rhizome 1.0–2.5 mm. Pseudobulbs obpyriform, flattened, 1.5–2.5 × 1.0–1.7 cm Leaf single, linear-oblong, subacute, obliquely notched, 6.5–13.5 × 1.0–1.5 cm. Inflorescence 1- or 2-racemose, basal from pseudobulb, few-flowered, calyx and corolla yellowish green, spotted with purple, ovate-oblong, obtuse. Lip simple, 4.0–4.5 × 1.0–1.5 cm, yellowish green with red margin. Column 2 triangular with projecting wings, stelidia filiform.

Global distribution. India, Bhutan, Bangladesh, China, Hainan, Laos, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting from August to October.

***Bulbophyllum rolfei* (Kuntze) Seidenf.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088° 18′06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0499 leg.; CUH 20287.

***Bulbophyllum roseopictum* J.J.Verm., Schuit. & de Vogel**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 13.III.2019; Rai & Moktan 0004 leg.; CUH 20114.

***Bulbophyllum wallichii* Rchb. f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 26°58′42″N, 088° 13′38″E; alt. 2200 m; 22.IX.2020; Rai & Moktan 0424 leg.; CUH 20114.

***Coelogyne barbata* Lindl. ex Griff.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rungbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 30.X.2020; Rai & Moktan 0488 leg.; CUH 20114.

***Coelogyne corymbosa* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Maney Bhanjyang; 26°59′ 15″N, 088°07′14″E; alt. 1920 m; 05.IV.2021; Rai & Moktan 0523 leg.; CUH 20114.

***Coelogyne cristata* Lindl.**
Figure 5K

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0197 leg.; CUH 20114.

Identification. Facultative epiphyte. Plant with stout rhizome. Pseudobulbs cylindrical-ovoid, smooth, 4.0–6.5 × 2.0–3.5 cm, leaves 2, linear-lanceolate, acute, sessile, 14.0–25.0 × 1.5–2.5 cm. Inflorescence heteranthous, pendent, 1- or 2-capitate, 3–10-flowered, flowers white, calyx elliptical-oblong, subacute, corolla elliptical-oblong, acute. Lip 4.5–3.5 cm, 3-lobed, white with yellow keels. Column curved white, long, winged. Anther oblong to ovate. Pollinia 4.

Global distribution. India, Bhutan, Bangladesh, Nepal, Tibet (POWO 2022).

Ecology. Common as epiphytes and lithophytes in STR, STM, and TMP and usually found in the trunk zone.

Phenology. Flowering and fruiting period from February to September.

***Coelogyne fimbriata* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Makaibari; 26°52′18″N, 088° 16′03″E; alt. 1390 m; 20.IX.2020; Rai & Moktan 0405 leg.; CUH 20245.

***Coelogyne flaccida* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 02.VII.2019; Rai & Moktan 0077 leg.; CUH 20130.

***Coelogyne occultata* Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088° 18′06″E; alt. 2510 m; 05.IV.2020; Rai & Moktan 0526 leg.; CUH 20301.

***Coelogyne punctulata* Lindl.**
Figure 6A

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0395 leg.; CUH 20236.

Identification. Holoepiphyte. Plant 10.5–29.0 cm long. Pseudobulbs subpyriform, sheathed, 3.5–6.5 cm long. Leaves 2, lanceolate, acute, petiolate, 14.0–20.0 × 2.0–3.5 cm. Inflorescence hysteranthous, 5- or 6-flowered, peduncle 5–9 cm, rachis 5–6 cm, zigzag. Flowers white, sepals similar, oblong-lanceolate, obtuse, petals linear-lanceolate, obtuse. Lip 2.5–3.5 cm, 3-lobed, white. Column long, winged.

Global distribution. India, Bhutan, China, Myanmar, Vietnam (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from October to January.

***Cymbidium aloifolium* (L.) Sw.**
Figure 6H

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 02.IX.2019; Rai & Moktan 0255 leg.; CUH 20187.

Identification. Holoepiphyte. Plant 29–95 cm tall. Pseudobulbs ovoid, 5.5 × 2.5 cm, smooth, flattened. Leaves 4 or 5, oblong, obtuse to emarginate, coriaceous, 30.5 × 95.0 cm. Inflorescence many-flowered, peduncle sheathed, rachis long, flower pale yellow cream, maroon-veined, callus yellow, calyx mucronate, erect, oblong, obtuse, corolla elliptical obtuse-acute, lip 1.5–2.0 × 1.0–1.5 cm, 3-lobed, erect. Column curved, winged at apex. Anther subquadrate. Pollinia 2.

Global distribution. India, Bhutan, Bangladesh, China, Malaya, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam (POWO 2022).

Ecology. Common in TRP, STR, and STM, and usually found in the trunk and inner crown zone.

Phenology. Flowering and fruiting period from April to July.

***Cymbidium bicolor* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088° 14′25″E; alt. 400 m; 20.IX.2020; Rai & Moktan 0407 leg.; CUH 20247.

***Cymbidium eburneum* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 24.VIII.2019; Rai & Moktan 0212 leg.; CUH 20166.

***Cymbidium elegans* Lindl.**
Figure 6B

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′18″N, 088° 18′41″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0390 leg.; CUH 20232.

Identification. Holoepiphyte. Plant 40.0–73.5 cm tall. Pseudobulbs subovoid. Leaves 43.5–79.0 × 2–2.5 cm, linear-elliptical, distichous, acuminate-obtuse. Inflorescence 20- to 36-flowered. Flower creamy yellow, bell-shaped, pendulous, floral bract small, sepals and petals similar, sepals obovate-lanceolate, petals linear-lanceolate. Lip triangular, 3.5–4.0 cm, 3-lobed, Column winged. Pollinia 2.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the inner crown zone.

Phenology. Flowering and fruiting period from October to January.

***Cymbidium erythraeum* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Third Mile; 27°00′39″N, 088° 17′34″E; alt. 2150 m; 02.IX.2019; Rai & Moktan 0275 leg.; CUH 20192.

***Cymbidium hookerianum* Rchb. f.**
Figure 5I

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gorkhey; 27°11′15″N, 088° 04′22″E; alt. 2800 m; 18.X.2021; Rai & Moktan 0613 leg.; CUH 20349.

Identification. Holoepiphyte. Plant 42.0–76.5 cm tall. Pseudobulbs narrowly ovoid. Leaves 7–12, 35.5–49.0 × 2.5–3.0 cm, linear-elliptical, sheathed, acute. Inflorescence 10- to 15-flowered. Flower yellowish green, 6.0–7.5 cm across, floral bract triangular, sepals almost similar, acute, dorsal sepal horizontal, lateral sepal spreading. Lip 4.5–4.7 cm, 3-lobed, with brownish-purple spotting, mucronate, 2 hairy lamellae on disc. Column winged. Anther yellow. Pollinia 2.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in TMP, and usually found in the inner crown zone.

Phenology. Flowering and fruiting period from March to August.

***Dendrobium amoenum* Wall. ex Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088° 14′25″E; alt. 400 m; 23.IX.2020; Rai & Moktan 0428 leg.; CUH 20258.

***Dendrobium aphyllum* (Roxb.) C.E.C.Fisch.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Tindharia; 26°51′11″N, 088° 19′59″E; alt. 860 m; 24.VIII.2019; Rai & Moktan 0221 leg.; CUH 20167.

***Dendrobium bicameratum* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 26.III.2019; Rai & Moktan 0025 leg.; CUH 20120.

***Dendrobium chrysanthum* Wall. ex Lindl.**

Figure 5L

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0397 leg.; CUH 20238.

Identification. Holoepiphyte. Plant pendulous, 55–95 cm tall. Stem straight sometimes wavy, yellowish beneath. Leaves distichous, elliptical to lanceolate, acute to acuminate, veined. Inflorescence lateral, 2- to 4-flowered, peduncle attenuate. Flowers 2.5 × 3.0 cm, golden yellow, fleshy, calyx subequal, dorsal sepal oblong-elliptical to ovate, lateral sepal falcate, corolla elliptical-ovate, obtuse. Lip 1.5–2.3 × 2.0–2.5 cm, simple, spotted with deep purple, column with short foot. Anther dome-shaped, pollinia 4.

Global distribution. India, Bhutan, China, Hainan, Laos, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from July to November.

***Dendrobium crepidatum* Lindl. & Paxton**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088° 14′25″E; alt. 400 m; 20.IX.2020; Rai & Moktan 0417 leg.; CUH 20253.

***Dendrobium denudans* D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 11.VIII.2019; Rai & Moktan 0129 leg.; CUH 20147.

***Dendrobium longicornu* Lindl.**
Figure 6G

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′ 06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0500 leg.; CUH 20288.

Identification. Holloepiphyte. Plant 15.5–47.0 cm long. Stem erect, sheathed. Leaves 5–14, 3.5–7 × 1.2–2 cm, oblong-lanceolate, subacute, emarginated. Inflorescence axillary, solitary-flowered, flower 3–4 cm, white, bract small lanceolate, calyx ovate-lanceolate, acuminate, corolla ovate-lanceolate, acute. Lip 2.0–3.0 × 2.0–2.5 cm, 3-lobed, white with yellow lamellae, margins entire; column 0.4–0.5 cm long. Anther dome-shaped. Pollinia 4.

Global distribution. India, Bhutan, Nepal, Thailand, Myanmar (POWO 2022).

Ecology. Common in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from August to December.

***Dendrobium moschatum* (Banks) Sw.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′16″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0369 leg.; CUH 20223.

***Dendrobium nobile* Lindl.**
Figure 6E

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 03.IX.2020; Rai & Moktan 0351 leg.; CUH 20211.

Identification. Holoepiphyte. Stem 27.0–49.5 cm, clustered, sheathed. Leaves 6–14, 5.4–10.0 × 1.5–3.0 cm, oblong, sessile, distichous, emarginated. Inflorescence lateral, 3- to 6-flowered. Flower whitish flower, 5.5–7.5 cm, floral bract tubular, sepals oblong-lanceolate, obtuse, petals ovate-oblong, obtuse, undulate. Lip simple, 3.0–3.5 × 2.5–3.0 cm, white with pale-yellow patches, ovate-oblong, entire. Column short. Anther white. Pollinia 4.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand (POWO 2022).

Ecology. Common in TRP, STR, and STM, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from March to August.

***Dendrobium pachyphyllum* (Kuntze) Bakh. f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chaityapani; 26°54′05″N, 088° 17′49″E; alt. 1924 m; 12.VIII.2019; Rai & Moktan 0149 leg.; CUH 20153.

***Dendrobium plicatile* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 01.IX.2019; Rai & Moktan 0250 leg.; CUH 20184.

***Dendrobium porphyrochilum* Lindl.**
Figure 5A

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gairibans; 27°02′53″N, 088° 01′48″E; alt. 2600 m; 05.IV.2021; Rai & Moktan 0533 leg.; CUH 20305.

Identification. Holoepiphyte. Plant 7–12 cm tall. Pseudobulbs conical, sheathed. Leaves 2–4, 4.0–7.0 × 0.5–1.0 cm, linear-oblong, sessile, jointed. Inflorescence solitary, terminal, 6- to 15-flowered. Flower greenish yellow with purple stripe, 1.0–1.5 cm, floral bract linear lanceolate, dorsal sepal lanceolate, acute, lateral sepal linear-lanceolate, acute. Lip 4.0–5.5 × 2.5–4.0 cm, dark purple with pale-green tip. Column broad and long. Anther suborbicular. Pollinia elongate.

Global distribution. India, China, Myanmar, Nepal, Thailand (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from May to August.

***Dendrobium rotundatum* (Lindl.) Hook.f.**
Figure 5B

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sukhia; 27°59′47″N, 088° 10′07″E; alt. 2150 m; 03.IV.2021; Rai & Moktan 0521 leg.; CUH 20297.

Identification. Holoepiphyte. Pseudobulbs 3.0–3.5 × 1.0–2.0 cm, ovoid, sheathed. Leaves 2, 7.5 × 1.5–3.0 cm, oblong-elliptical. Inflorescence solitary. Flower 2.1–3.0 cm, green, floral bract lanceolate, dorsal sepal ovate, lateral sepal falcate, subacute. Lip 1.0–2.0 × 1.0–1.5 cm, 3-lobed, side lobes orbicular. Column curved, toothed. Anther obtuse-ovate. Pollinia 4.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Tibet (POWO 2022).

Ecology. Common in TMP and STM, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from September to March.

***Dendrobium transparens* Wall. ex Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 24.VIII.2019; Rai & Moktan 0208 leg.; CUH 20165.

***Eria coronaria* (Lindl.) Rchb. f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 08.IV.2021; Rai & Moktan 0545 leg.; CUH 20309.

***Gastrochilus affinis* (King & Pantl.) Schltr.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088° 18′06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0501 leg.; CUH 20289.

***Gastrochilus calceolaris* (Buch.-Ham. ex Sm.) D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Third Mile; 27°00′39″N, 088° 17′34″E; alt. 2150 m; 04.IX.2019; Rai & Moktan 0286 leg.; CUH 20193.

***Liparis resupinata* Ridl.**
Figure 5J

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 26°58′50″N, 088° 13′48″E; alt. 2200 m; 04.IV.2021; Rai & Moktan 0564 leg.; CUH 20323.

Identification. Holoepiphyte. Plant epiphytic herb. Pseudobulbs 1.5–3 × 0.5–1 cm, cylindrical, sheathed. Leaves 2–4, 5.0–10.0 × 0.3–1.0 cm, alternate, linear-lanceolate, acute, sessile. Inflorescence 10- to 40-flowered, slender, bracteolate. Flowers 0.5 × 0.7 cm, yellowish green, floral bract lanceolate, calyx oblong, obtuse, dorsal sepal retroflexed, lateral sepals spreading, corolla linear, obtuse, lip ovate, 0.2–0.3 cm, obtuse apex. Column winged. Pollinia 4.

Global distribution. India, Bangladesh, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as an epiphyte in STM and TMP, and usually found in the trunk and inner crown zones.

Phenology. Flowering and fruiting period from October to May.

***Liparis viridiflora* (Blume) Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′ 41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0358 leg.; CUH 20217.

***Oberoniae marginata* King &Pantl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 29.VIII.2020; Rai & Moktan 0315 leg.; CUH 20198.

***Oberonia pachyrachis* Rchb. f. ex Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′42″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0394 leg.; CUH 20235.

***Otochilus albus* Lindl.**
Figure 5C

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 10.IV.2020; Rai & Moktan 0559 leg.; CUH 20321.

Identification. Holoepiphyte. Pseudobulbs 5–7 cm long, grooved, sheathed. Leaves 2, 9.5–14.0 × 2.0–3.5 cm, ovate-lanceolate, acuminate, petiolate. Inflorescence synanthous, 10- to 16-flowered, flowers 1.5–2 cm across, white, floral bracts ovate-lanceolate, calyx and corolla oblong-lanceolate, acute. Lip 0.5 × 2.5 cm, 3-lobed, yellowish white. Column winged, slender. Pollinia 4.

Global distribution. India, Bangladesh, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as epiphytes in STR and STM, and usually found in the trunk zone and inner crown zone.

Phenology. Flowering and fruiting period from June to July.

***Otochilus fuscus* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 13.III.2019; Rai & Moktan 0006 leg.; CUH 20116.

***Otochilus lancilabius* Seidenf.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0196 leg.; CUH 20161.

***Panisea uniflora* (Lindl.) Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088° 14′25″E; alt. 400 m; 20.IX.2020; Rai & Moktan 0406 leg.; CUH 20246.

***Papilionanthe teres* (Roxb.) Schltr**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 29.VIII.2020; Rai & Moktan 0313 leg.; CUH 20196.

***Pinalia acervata* (Lindl.) Kuntze**

Material examined. INDIA – Eastern Himalaya •

West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 29.VIII.2020; Rai & Moktan 0314 leg.; CUH 20197.

***Pinalia spicata* (D.Don) S.C.Chen & J.J.Wood**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′ 41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0359 leg.; CUH 20218.

***Pleione humilis* (Sm.) D.Don**
Figure 5D

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gorkhey; 27°11′15″N, 088° 04′22″E; alt. 2800 m; 17.X.2021; Rai & Moktan 0612 leg.; CUH 20348.

Identification. Holoepiphyte. Plant 6–10 cm tall. Pseudobulbs ovoid-conical. Leaf single, 16.8–24.5 × 2.5–4 cm, oblanceolate, acute, during anthesis absent. Inflorescence 1- or 2-flowered, peduncle sheathed. Flower white, 5.5–6.5 cm, floral bract obovate, sepals white, dorsal sepal oblong-lanceolate. Lip 4.0–7.5 × 2.5–4.0 cm, 3-lobed, whitish yellow with yellowish-brown stripes and spots on disc, emarginated. Column 3.0–3.5 cm long, winged. Anther ovate. Pollinia 4.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand (POWO 2022).

Ecology. Less frequent in TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from January to April.

***Pleione praecox* (Sm.) D.Don**
Figure 5F

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 02.IX.2019; Rai & Moktan 0269 leg.; CUH 20190.

Identification. Holoepiphyte. Herb. Plant 8.5–19.0 cm tall. Pseudobulbss contracted above into a beak. Leaf single or double, 6.8–18.5 × 3.5–5.0 cm, elliptical-lanceolate, acuminate, petiolate, sheathed. Inflorescence 1- or 2-flowered, peduncle sheathed. Flower purple, 4.5–6 cm, floral bract elliptical sepals similar. Lip 4.0–6.5 × 3.5–4.5 cm, 3-lobed, layered with yellow on disc, elliptic. Column 3.6–4.5 cm long, slender. Anther whitish. Pollinia 4.

Global distribution. India, Bhutan, Bangladesh, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STR and STM, and usually found in the trunk and inner crown zones.

Phenology. Flowering and fruiting period from September to December.

***Porpax elwesii* (Rchb. f.) Rolfe**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0191 leg.; CUH 20160.

***Porpax filiformis* (Wight) Schuit., Y.P.Ng & H.A.Pedersen**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 01.IX.2021; Rai & Moktan 0251 leg.; CUH 20185.

***Rhynchostylis retusa* (L.) Blume**
Figure 6C

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gayabari; 26°51′35″N, 088° 19′34″E; alt. 1071 m; 01.VII.2019; Rai & Moktan 0059 leg.; CUH 20127.

Identification. Holoepiphyte. Stem pendulous, covered by leaf sheaths, 11.5–29.0 cm long. Leaves distichous, apex obliquely 2-lobed, coriaceous, sessile, 10–34 × 1–3 cm. Inflorescence many-flowered, peduncle 3-sheathed, 6.5–9.0 cm long, rachis glabrous, floral bracts ovate, acute. Flower 1.5–4.0 cm, sepals and petals white with a few light purple dots, dorsal sepal elliptical obtuse, lateral sepal obliquely ovate, obtuse. Lip light purple, white at apex, spur white, 1.4–6.5 × 2.0–3.5 cm. Column 0.3–0.5 cm long. Anther ovoid. Fruit ellipsoid.

Global distribution. India, Bhutan, Bangladesh, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STR and STM and usually found in the trunk zone.

Phenology. Flowering and fruiting period from May to September.

***Thunia alba* (Lindl.) Rchb. f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gayabari; 26°51′35″N, 088° 19′34″E; alt. 1071 m; 01.VII.2019; Rai & Moktan 0069 leg.; CUH 20128.

***Uncifera obtusifolia* Lindl.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0363 leg.; CUH 20219.

***Vanda cristata* Wall. ex Lindl.**
Figure 6D

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 29.VIII.2020; Rai & Moktan 0311 leg.; CUH 20194.

Identification. Holoepiphyte. Stem stout, covered by leaf sheaths, 12–32 cm long, roots piercing through leaf sheaths. Leaves recurved, apex 3-dentate, coriaceous,

8.0–14.0 × 0.5–2.0 cm. Inflorescence 3- to 6-flowered, peduncle, sheathed, 2.5–6.0 cm long, floral bracts ovate-triangular, obtuse. Flower 4.5–5.0 cm, sepals and petals greenish yellow, dorsal sepal incurved, oblong, obtuse, lateral sepal similar. Lip fleshy, golden-yellow to white, 2.0–2.5 × 1.0–1.5 cm. Column 0.5–0.6 cm long. Anther ovoid. Fruit not observed.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand (POWO 2022).

Ecology. Common in TRP and STR, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from April to August.

***Vandopsis undulata* (Lindl.) J.J.Sm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0357 leg.; CUH 20216.

Asparagaceae Juss.

***Maianthemum fuscum* (Wall.) LaFrankie**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gorkhey; 27°11′15″N, 088° 04′22″E; alt. 2800 m; 17.X.2021; Rai & Moktan 0611 leg.; CUH 20347.

***Polygonatum brevistylum* Baker**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rajahatta; 26°57′20″N, 088° 17′36″E; alt. 2037 m; 07.IX.2020; Rai & Moktan 0372 leg.; CUH 20225.

***Polygonatum cathcartii* Baker**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0601 leg.; CUH 203421.

***Polygonatum oppositifolium* (Wall.) Royle**
Figure 7F

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Loleygaon; 27°00′20″N, 088° 32′30″E; alt. 1670 m; 04.IX.2020; Rai and Moktan 0352 leg.; CUH 20212.

Identification. Facultative epiphyte. Rhizome branched 1.0–1.2 cm, thick. Stem glabrous 40–80 cm. Leaves many, opposite, sub leathery with distinct cross veins, lanceolate to narrowly elliptical-acuminate to caudate, 5.8–12.0 × 1.5–5.0 cm, petiole short 0.2–1.0 cm. Scale leaves triangular to oblong. Intermediate leaf is sometimes present. Inflorescence 3- to 8-flowered, Peduncle pendulous 1.2–2.5 cm, pedicels short, 0.8–1.9 cm, stiff. Flowers white, tubular, tube 8.2–12.0 mm, lobes 3.5–4.6 mm. Filaments papillose, sometimes smooth proximally. Anthers acute, bases long, slightly divergent. Fruit berry.

Global distribution. India, Bhutan, Bangladesh, China, Nepal, Myanmar (POWO 2022).

Ecology. Common in TMP and STM, and usually found in the trunk zone and on rock surfaces.

Phenology. Flowering and fruiting period from May to August.

***Polygonatum punctatum* Royle ex Kunth**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088° 18′59″E; alt. 1700 m; 04.IV.2019; Rai & Moktan 0057 leg.; CUH 20126.

Commelinaceae Mirb.

***Cyanotis cristata* (L.) D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 30.VIII.2019; Rai & Moktan 0236 leg.; CUH 20178.

***Floscopa scandens* Lour.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1100 m; 03.VII.2019; Rai & Moktan 0086 leg.; CUH 20134.

Zingiberaceae Martinov

***Cautleya spicata* (Sm.) Baker**
Figure 6L

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0180 leg.; CUH 20155.

Identification. Facultative epiphyte. Leafy shoot, 35–43 cm. Leaves 4–7, 5.5–18.0 × 2.0–3.5 cm, lanceolate, caudate, sessile. Inflorescence 5–12 cm, bracts reddish, unilaterally split, petals oblong, rounded, 2.0–2.5 cm. Lip bilobed, filament short. Fruit capsule, red, globose.

Global distribution. India, Bhutan, China, Myanmar, Nepal (POWO 2022).

Ecology. Common in STR and STM, and usually found on lower trunk zone.

Phenology. Flowering and fruiting period from May to September.

***Globba clarkei* Baker**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rajahatta; 26°57′20″N, 088° 17′36″E; alt. 2037 m; 07.IX.2020; Rai & Moktan 0371 leg.; CUH 20224.

***Globba multiflora* Wall. ex Baker**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N,

088°18′59″E; alt. 1700 m; 30.VIII.2021; Rai & Moktan 0247 leg.; CUH 20183.

***Hedychium ellipticum* Buch.-Ham. ex Sm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 21.IX.2020; Rai & Moktan 0418 leg.; CUH 20254.

***Hedychium griffithianum* Wall.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.IX.2019; Rai & Moktan 0198 leg.; CUH 20163.

Papaveraceae Juss.

***Dactylicapnos scandens* (D.Don) Hutch.**
Figure 7K

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0603 leg.; CUH 20344.

Identification. Hemiepiphyte. Plant up to 3.5 m. Leaves ternate, 2 or 3, leaflets 0.8–3.0 × 0.5–2.0 cm, ovate-elliptical, apex acute-obtuse, base cuneate. Inflorescence racemes, 8- to 10-flowered, bracts lanceolate, 0.5–1.2 cm. Sepals 0.3–0.5 cm, triangular. Petals yellow, nectariferous glands present, hooked at apex. Fruit ovoid, 1.5–2.0 × 0.5–0.8 cm.

Global distribution. India, Bhutan, China, Korea, Nepal, Thailand, Vietnam (POWO 2022).

Ecology. Common in TMP.

Phenology. Flowering and fruiting period from June to September.

Lardizabalaceae R.Br.

***Holboellia angustifolia* Wall.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0604 leg.; CUH 20345.

Ranunculaceae Juss.

***Clematis buchananiana* DC.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 28.VIII.2019; Rai & Moktan 0228 leg.; CUH 20172.

Vitaceae Juss.

***Ampelocissus sikkimensis* (Lawson) Planch.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1100 m; 03.VII.2019; Rai & Moktan 0090 leg.; CUH 20135.

***Cayratia pedata* (Wall.) Gagnep.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088°24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0181 leg.; CUH 20156.

***Cissus javana* DC.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088°24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0190 leg.; CUH 20159.

***Tetrastigma serrulatum* (Roxb.) Planch.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rajahatta; 26°57′20″N, 088° 17′36″E; alt. 2037 m; 07.IX.2020; Rai & Moktan 0374 leg.; CUH 20226.

Rosaceae Juss.

***Sorbus rhamnoides* (Decne.) Rehder**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0598 leg.; CUH 20339.

Moraceae Gaudich.

***Ficus sarmentosa* Buch.-Ham. ex Sm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0356 leg.; CUH 20215.

Urticaceae Juss.

***Elatostema lineolatum* Wight**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088° 21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0354 leg.; CUH 20213.

***Elatostema monandrum* (Buch.-Ham. ex D.Don) Hara**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0464 leg.; CUH 20270.

***Pilea microphylla* (L.) Liebm**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 30.VIII.2019; Rai & Moktan 0242 leg.; CUH 20182.

***Pilea scripta* (Buch.-Ham. ex D.Don) Wedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0176 leg.; CUH 20154.

***Pilea ternifolia* Wedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°00′06″N, 088° 14′35″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0101 leg.; CUH 20138.

Cucurbitaceae Juss.

***Herpetospermum tonglense* (C.B.Clarke) H.Schaef. &S.S.Renner**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Tonglu; 27°01′48″N, 088°05′ 33″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0495 leg.; CUH 20285.

Begoniaceae C.Agardh

***Begonia flaviflora* Hara**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 11.VIII.2019; Rai & Moktan 0146 leg.; CUH 20152.

***Begonia hatacoa* Buch.-Ham.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°00′04″N, 088° 14′39″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0107 leg.; CUH 20141.

Celastraceae R.Br.

***Euonymus viburnoides* Prain**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 09.IV.2021; Rai & Moktan 0552 leg.; CUH 20314.

Santalaceae R.Br.

***Dendrotrophe granulata* (Hook.f. & Thomson ex A.DC.) A.N.Henry & B.Roy**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 04.IV.2019; Rai & Moktan 0042 leg.; CUH 20125.

Primulaceae Batsch ex Borkh.

***Embelia frondosa* (King ex Gamble) D.G.Long**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088°20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0404 leg.; CUH 20244.

Ericaceae Durande

***Agapetes auriculata* (Griff.) Benth. & Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1100 m; 03.VII.2019; Rai & Moktan 0082 leg.; CUH 20133.

***Agapetes incurvata* (Griff.) Sleumer**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 11.IV.2021; Rai & Moktan 0568 leg.; CUH 20327.

***Agapetes saligna* (Hook.f.) Benth. & Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′ 57″E; alt. 1900 m; 10.IV.2021; Rai & Moktan 0561 leg.; CUH 20322.

***Agapetes serpens* (Wight) Sleumer**
Figure 7A

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 26°58′50″N, 088°13′48″E; alt. 2200 m; 10.IV.2021; Rai & Moktan 0557 leg.; CUH 20319.

Identification. Facultative epiphyte. Plant pendulous, 40–60 cm. Shoots covered with hairs, twig terete 0.9–2.0 mm in diameter. Leaves crowded, borne in 1 plane, ovate-lanceolate, 0.9–1.5 × 0.5–0.8 cm, apex subacute, base rounded, margins recurved, subsessile. Inflorescence fasciculate. Flower solitary, pedicels 0.5–1.5 mm, hairy. Sepals 5-winged, lanceolate, hairy, apex acute to subobtuse, 3.5–4.5 mm. Corolla bright red with darker zigzag bands, tubular 1.1–2.7 cm, lobes recurved. Anthers 5.5–9 mm, apical tubes 11.5–14.8 mm, without spurred. Fruit berry.

Global distribution. India, Bhutan, Nepal (POWO 2022).

Ecology. Common as epiphytes and mesophytes in STM and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from February to May.

***Agapetes smithiana* Sleumer**
Figure 6K

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0483 leg.; CUH 20277.

Identification. Facultative epiphyte. Plant similar to *Agapetes serpens*, but leaf elliptical to obovate, 1.2–3.5 × 0.5–1.8 cm, apex rounded, base cuneate. Flower solitary,

corolla yellow, pedicels 0.3–0.5 cm. Fruit not observed.

Global distribution. India, Bhutan, Nepal (POWO 2022).

Ecology. Common as epiphytes and mesophytes in STM and TMP and usually found in the trunk zone.

Phenology. Flowering and fruiting period from June to September.

***Rhododendron vaccinioides* Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gorkhey; 27°11′15″N, 088°04′ 22″E; alt. 2800 m; 18.X.2021; Rai & Moktan 0615 leg.; CUH 20351.

***Vaccinium dunalianum* Wight**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′ 57″E; alt. 1900 m; 10.VI.2021; Rai & Moktan 0581 leg.; CUH 20333.

***Vaccinium nummularia* Hook.f. & Thomson ex C.B.Clarke**
Figure 7B

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gorkhey; 27°11′15″N, 088°04′ 22″E; alt. 2800 m; 18.X.2021; Rai & Moktan 0614 leg.; CUH 20350.

Identification. Holoepiphyte. Stem 0.3–1.0 m, young shoot rough with bristles. Leaves elliptical 4.5–14.0 × 5.0–9.5 cm, base rounded, margins shallowly ciliate, subsessile. Inflorescence racemes, 10- to 16-flowered, condensed, bracts elliptical bracteoles 2.5–5.5 mm. Sepals triangular; Corolla barrel-shaped, apex constricted, white or pink, lobes deep pink, minute. Anther tips tubular.

Global distribution. India, Bhutan, China, Nepal, Myanmar (POWO 2022).

Ecology. Common in higher elevations and usually found in the trunk zone.

Phenology. Flowering and fruiting period from April to August.

***Vaccinium retusum* (Griff.) Hook.f. ex C.B.Clarke**
Figure 7L

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, One Block; 26°56′22″N, 088° 19′08″E; alt. 1900 m; 06.IV.2021; Rai & Moktan 0544 leg.; CUH 20308.

Identification. Holoepiphyte. Stem 1–2 m, young shoot pubescent. Leaves obovate, 14.0–24.0 × 6.5–9.5 cm, shallowly retuse, base attenuated, margins recurved, entire, glabrous, petioles 1.0–2.5 mm. Inflorescence racemes, 10- to 20-flowered, 2.5–4.0 cm, pubescent, bracts elliptical, bracteoles 2.5–5.5 mm. Sepals triangular. Corolla barrel-shaped, apex constricted, white or pink, lobes deep pink, minute. Anther tips tubular. Filaments hairy. Fruit not observed.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Tibet, Vietnam (POWO 2022).

Ecology. Common as epiphytes in STM and TMP and usually found in the trunk zone.

Phenology. Flowering and fruiting period from April to August.

***Vaccinium vacciniaceum* (Roxb.) Sleumer**
Figure 7D

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 02.VII.2019; Rai & Moktan 0079 leg.; CUH 20131.

Identification. Facultative epiphyte. Stem 1.0–2.5 m, young shoot glabrous. Leaves whorled, 4.5–7.8 × 2.5–3.5 cm, elliptical base attenuated, margins serrate, petioles 1.5–2.5 mm. Inflorescence racemes, 10- to 26-flowered, 2.5–10.0 cm, pubescent, bracts triangular, bracteoles 2.5–5.5 mm. Sepals triangular. Corolla urn-shaped, greenish-white, lobes small. Anther tips tubular. Filaments hairy. Fruit 3.5–5.0 mm.

Global distribution. India, Bhutan, China, Nepal, Bangladesh (POWO 2022).

Ecology. Common as epiphytes in STM and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from March to August.

Rubiaceae Juss.

***Mycetia longifolia* (Wall.) Kuntze**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sixth Mile; 27°01′48″N, 088°19′24″E; alt. 1963 m; 04.IV.2021; Rai & Moktan 0520 leg.; CUH 20298.

***Neohymenopogon parasiticus* (Wall.) Bennet**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088°20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0398 leg.; CUH 20239.

Apocynaceae Juss.

***Ceropegia meyeri* Decne.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′57″E; alt. 1900 m; 10.IV.2021; Rai & Moktan 0558 leg.; CUH 20320.

***Dischidia bengalensis* Colebr.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088°22′10″E; alt. 1114 m; 02.IX.2019; Rai & Moktan 0259 leg.; CUH 20188.

***Hoya acuta* Haw.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 28.VIII.2019; Rai & Moktan 0234 leg.; CUH 20177.

***Hoya arnottiana* Wight**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 29.VIII.2020; Rai & Moktan 0312 leg.; CUH 20195.

***Hoya bella* Hook.**
Figure 7J

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0183 leg.; CUH 20157.

Identification. Holoepiphyte. Plant pendulous. Stem stout. Leaves dark green above, paler below, elongate, rhomboid to ovate-lanceolate, 1.0–5.5 × 0.5–2.0 cm, apex acute to acuminate, base cuneate, 1.0–2.0 mm thick, fleshy and coriaceous, petiole 1.0–4.5 mm. Inflorescence umbel, peduncle long and stout, 1.0–1.5 cm, pedicel 1.0–1.5 cm. Flowers white broad sometimes with a pink to crimson centre, calyx lobes lanceolate, 2.0–3.0 × 0.8–1.2 mm, corolla glabrous outside, papillose, lobes triangular, staminal coronal scales short rounded or elliptical white or crimson. Fruit not observed.

Global distribution. India, Nepal, Thailand (POWO 2022).

Ecology. Common as epiphytes in STR and STM, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from May to August.

***Hoya edeni* King ex Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0403 leg.; CUH 20243.

***Hoya fusca* Wall.**
Figure 7C

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Third Mile; 27°00′39″N, 088° 17′34″E; alt. 2150 m; 11.VIII.2019; Rai & Moktan 0132 leg.; CUH 20149.

Identification. Holoepiphyte.Stem stout. Leaves fleshy, linear to oblong, 9.5–21.0 cm, apex acuminate, base cuneate, petiole 0.8–2.5 cm long stout. Inflorescence terminal sessile umbel. Flower yellow-brown with a cream centre, peduncle 2–3.5 cm, short and stout, pedicel 1–2 cm thick and fleshy, calyx lobes ovate to ovate-oblong, rounded, 2–3 mm, glabrous, corolla glabrous outside, pubescent inside, lobes triangular-ovate, acute 3.5–4.0 mm. Staminal coronal scales short and thick. Follicles straight and slender.

Global distribution. India, Bangladesh, Bhutan, China, Hainan, Laos, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as epiphytes in STM and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from August to October.

***Hoya lanceolata* Wall. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0399 leg.; CUH 20240.

***Hoya latifolia* G.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′ 41″E; alt. 1900 m; 17.VI.2021; Rai & Moktan 0596 leg.; CUH 20337.

***Hoya linearis* Wall. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088°22′ 10″E; alt. 1114 m; 02.IX.2019; Rai & Moktan 0264 leg.; CUH 20189.

***Hoya longifolia* Wall. ex Wight**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 11.IV.2021; Rai & Moktan 0569 leg.; CUH 20328.

***Hoya obcordata* Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 29.VIII.2020; Rai & Moktan 0317 leg.; CUH 20200.

***Hoya polyneura* Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′ 41″E; alt. 1900 m; 17.VI.2021; Rai & Moktan 0597 leg.; CUH 20338.

***Hoya serpens* Hook.f.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1100 m; 04.IV.2019; Rai & Moktan 0040 leg.; CUH 20124.

Gesneriaceae Rich. & Juss.

***Aeschynanthus acuminatus* Wall. ex A.DC.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 09.IV.2021; Rai & Moktan 0551 leg.; CUH 20313.

***Aeschynanthus bracteatus* Wall. ex A.DC.**
Figure 7E

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088°20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0402 leg.; CUH 20242.

Identification. Holoepiphyte. Stem 1.5–2.0 m long. Leaves fleshy, opposite, ovate, 5.5–11.0 × 2.0–4.5 cm, apex acuminate, base rounded, petiole 0.1–1.5 cm long. Inflorescence cyme, 3- to 5-flowered, peduncle 1.5–5.0 cm long, pedicel 1.0–2.5 cm, calyx lobes lanceolate-elliptical 1.5–3.0 × 0.4–0.8 cm, corolla glabrous outside, pubescent inside, 4–5 cm long, upper lip erect, lower lip 3-lobed, crimson or scarlet. Stamens far-exserted, disc annular. Fruit 12–15 cm long.

Global distribution. India, Bhutan, China, Hainan, Myanmar, Nepal (POWO 2022).

Ecology. Common as epiphytes in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from July to October.

***Aeschynanthus hookeri* C.B.Clarke**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt.1900 m; 09.IV.2021; Rai & Moktan 0549 leg.; CUH 20312.

***Aeschynanthus parviflorus* (D.Don) Spreng.**
Figure 7I

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0391 leg.; CUH 20233.

Identification. Holoepiphyte. Stem 1–1.5 m long, spreading. Leaves fleshy, opposite, elliptical 6.5–12.0 × 2.0–4.5 cm, apex acuminate, base cuneate, petiole 0.8–1.5 cm long. Flowers many, clustered at tip of the stem, bracts linear-lanceolate, calyx lobes triangular, light yellowish orange, tube 2–4 mm long, corolla orange or orange-scarlet pubescent outside, 2.4–3.5 cm long, tube curved and inflated. Stamens far-exserted, disc annular. Fruit 12–20 cm long.

Global distribution. India, Bhutan, China, Hainan, Myanmar, Nepal (POWO 2022).

Ecology. Common in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from July to October.

***Codonanthe devosiana* Lem.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sukhia; 27°59′47″N, 088° 10′07″E; alt. 2150 m; 03.IV.2021; Rai & Moktan 0519 leg.; CUH 20296.

***Didymocarpus albicalyx* C.B.Clarke**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Tindharia; 26°51′11″N, 088° 19′59″E; alt. 860 m; 24.VIII.2019; Rai & Moktan 0222 leg.; CUH 20168.

***Didymocarpus aromaticus* Wall. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0480 leg.; CUH 20274.

***Henckelia pumila* (D.Don) A.Dietr.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 10.IV.2021; Rai & Moktan 0555 leg.; CUH 20317.

***Loxostigma griffithii* (Wight) C.B.Clarke**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 10.VI.2021; Rai & Moktan 0582 leg.; CUH 20334.

***Lysionotus atropurpureus* H.Hara**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0482 leg.; CUH 20276.

***Lysionotus serratus* D.Don**
Figure 7G

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088° 24′16″E; alt. 1120 m; 22.VIII.2019; Rai & Moktan 0187 leg.; CUH 20158.

Identification. Holoepiphyte. Stem 12.0–30.5 cm long. Leaves elliptical 3.5–16.0 × 1.2–5.5 cm, apex acuminate, base cuneate, margin serrate, petiole 0.4–1.5 cm long. Inflorescence cyme, many-flowered, calyx lobes lanceolate, acute, 5.5–12 × 2.0 mm, corolla purplish white with purple stripes, lower lip has 2 yellow bars, upper lip shorter, lobes ovate. Anthers are connected with lateral appendages. Fruit not observed.

Global distribution. India, Bhutan, China, Hainan, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as epiphytes in TRP, STR, and STM, and usually found in the trunk zone.

Phenology. Flowering and fruiting period from July to October.

Acanthaceae Juss.

***Thunbergia coccinea* Wall. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°00′06″N, 088° 14′35″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0115 leg.; CUH 20142.

***Thunbergia lutea* T.Anderson**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 11.VIII.2019; Rai & Moktan 0128 leg.; CUH 20146.

Lamiaceae Martinov

***Premna corymbosa* Rottler & Willd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088° 16′00″E; alt. 550 m; 29.VIII.2019; Rai & Moktan 0229 leg.; CUH 20173.

***Premna interrupta* Wall. ex Schauer**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088° 16′57″E; alt. 1900 m; 10.IV.2021; Rai & Moktan 0565 leg.; CUH 20324.

Asteraceae Bercht. & J.Presl

***Senecio buimalia* Buch.-Ham. ex D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1100 m; 03.VII.2019; Rai & Moktan 0091 leg.; CUH 20136.

Pittosporaceae R.Br.

***Pittosporum napaulense* (DC.) Rehder & Wilson**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 26°58′50″N, 088° 13′48″E; alt. 2200 m; 04.IV.2021; Rai & Moktan 0522 leg.; CUH 20299.

Araliaceae Juss.

***Aralia leschenaultii* (DC.) J.Wen**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088° 18′06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0492 leg.; CUH 20282.

Lycopodiaceae P.Beauv.ex Mirb.

***Huperzia hamiltonii* (Spreng.) Trevis.**

Figure 8A

Material examined. INDIA – Eastern Himalaya·West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0498 leg.; CUH 20286.

Identification. Holoepiphyte. Plant pendulous. Plant 9.5–24.0 cm, long, stout, dichotomously forked. Microphylls arranged loosely, oblong, obtuse apex, base narrow, margin entire, distinct midrib, sessile to short-stalked. Veins less distinct. Sporophyll like vegetative leaves, smaller than tropophylls. Sporangia yellowish, on the axil of the sporophyll.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Tibet (POWO 2022).

Ecology. Common in STM, TMP, and SAL, and usually found in the trunk zone.

Phenology. Fertile period from July to October.

***Huperzia phlegmaria* (L.) Rothm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0392 leg.; CUH 20234.

***Huperzia pulcherrima* (Wall. ex Hook. & Grev.) Pic. Serm.**

Figure 8J

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 11.VIII.2019; Rai & Moktan 0131 leg.; CUH 20148.

Identification. Holoepiphyte. Plant pendulous, 10.5–44.0 × 0.5–1.5 cm long, stout, dichotomously forked. Microphylls linear, oblong, obtuse apex, base decurrent, margin wavy, indistinct midrib. Sporophyll like vegetative leaves. Sporangia in the axil of sporophyll, yellowish.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Tibet (POWO 2022).

Ecology. Common in STR and STM, and usually found in the trunk zone.

Phenology. Fertile period from July to October.

***Huperzia squarrosa* (G.Forst.) Trevis.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahanadi; 26°52′57″N, 088° 19′13″E; alt. 1296 m; 29.VIII.2020; Rai & Moktan 0316 leg.; CUH 20199.

Hymenophyllaceae Mart.

***Hymenophyllum badium* Hook. & Grev.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gairibans; 27°02′53″N, 088° 01′48″E; alt. 2600 m; 02.XI.2020; Rai & Moktan 0494 leg.; CUH 20284.

***Hymenophyllum exsertum* Wall. ex Hook.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 02.IX.2019; Rai & Moktan 0252 leg.; CUH 20186.

***Hymenophyllum simonsianum* Hook.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, One Block; 26°56′22″N, 088° 19′08″E; alt. 1900 m; 06.IV.2021; Rai & Moktan 0543 leg.; CUH 20307.

***Hymenophyllum tenellum* D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rungbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0471 leg.; CUH 20271.

Pteridaceae E.D.M.Kirchn.

***Antrophyum coriaceum* (D.Don) Wall. ex T. Moore**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 30.VIII.2019; Rai & Moktan 0237 leg.; CUH 20179.

***Vittaria elongata* Sw.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gairibans; 27°02′53″N, 088° 01′48″E; alt. 2600 m; 05.IV.2021; Rai & Moktan 0528 leg.; CUH 20303.

***Vittaria flexuosa* Fee**
Figure 9L

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Third Mile; 27°00′39″N, 088° 17′34″E; alt. 2150 m; 11.VIII.2019; Rai & Moktan 0133 leg.; CUH 20150.

Identification. Holoepiphte. Fronds clustered, drooping. Lamina, simple, tufted, 23.0–42.0 × 0.3–0.4 cm, linear, apex acuminate, base narrowed gradually, entire. Stipe 0.5–3.5 cm. Veins distinct. Sori submarginal, linear, elongated, brown, linear, indusiate. Rhizome short, creeping, covered with scales.

Global distribution. India, Bhutan, China, Japan, Myanmar, Nepal, Thailand, Taiwan, Vietnam (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the trunk zone.

Phenology. Fertile period from July to October.

***Vittaria himalayensis* Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gumbagaon; 26°56′43″N, 088° 20′34″E; alt. 1300 m; 10.IX.2020; Rai & Moktan 0401 leg.; CUH 20241.

***Vittaria ophiopogonoides* Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 30.VIII.2020; Rai & Moktan 0319 leg.; CUH 20202.

***Vittaria sikkimensis* Kuhn**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′57″E; alt. 1900 m; 08.IV.2021; Rai & Moktan 0546 leg.; CUH 20310.

Aspleniaceae Newman

***Asplenium ensiforme* Wall. ex Hook. & Grev.**
Figure 9I

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088° 18′59″E; alt. 1700 m; 11.IV.2021; Rai & Moktan 0570 leg.; CUH 20329.

Identification. Holoepiphye. Lamina 5.5–36.0 cm, simple, ovate-lanceolate, entire, coriaceous, acuminate. Rhizome erect, scaly, scales black, lanceolate. Stipe small, winged, veins obscure and forked. Sori brown, linear, indusium toothed.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Sri Lanka, Taiwan, Vietnam (POWO 2022).

Ecology. Common in STM and TMP and usually found in the trunk zone.

Phenology. Fertile period from June to September.

***Asplenium laciniatum* D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′22″N, 088° 18′40″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0375 leg.; CUH 20227.

***Asplenium nidus* L.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 04.IV.2019; Rai & Moktan 0039 leg.; CUH 20123.

***Asplenium phyllitidis* D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°

16′00″E; alt. 550 m; 29.VIII.2019; Rai & Moktan 0230 leg.; CUH 20174.

***Asplenium planicaule* Wall. ex Mett.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rungbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0452 leg.; CUH 20266.

***Asplenium tenuifolium* D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rungbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0456 leg.; CUH 20268.

***Asplenium yoshinagae* Makino**
Figure 9C

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Latpanchar; 26°54′52″N, 088°24′16″E; alt. 1120 m; 26.III.2019; Rai & Moktan 0027 leg.; CUH 20121.

Identification. Facultative epiphyte. Fronds caespitose. Lamina 20.5–55.0 cm, linear-lanceolate, coriaceous, apex acute. Pinnae 13- to 26-paired, asymmetric, rhomboid, stalk short, lobed deeply, margin dentate, apex acute, base cuneate. Stipe 3.5–19.0 cm, scaly. Veins obvious, multiforked. Sori linear, arise from near costa to near margin, elongate, persistent. Rhizome erect, short, dark brown, densely scaly.

Global distribution. India, Bhutan, China, Japan, Korea, Myanmar, Nepal, Thailand, Vietnam (POWO 2022).

Ecology. Common in TRP and STR, and usually found in the trunk zone and inner crown zone. **Phenology.** Fertile period from June to November.

Hypodematiaceae Ching

***Leucostegia truncata* (D.Don) Fraser-Jenk.**
Figure 9D

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chaityapani; 26°54′05″N, 088°17′49″E; alt. 1924 m; 02.IX.2020; Rai & Moktan 0328 leg.; CUH 20206.

Identification. Holoepiphyte. Plants pendulous. Fronds tripinnate, 28.5–59.5 × 12.5–15.5 cm. Lamina deltoid, glabrous. Pinnae 5- to 9-paired, alternate, lanceolate, acuminate. Pinnules 4- to 6-paired, subsessile, ovate-lanceolate. Veins distinct, forked. Stipes stramineous, 10.5–21.0 cm. Sori globose, yellowish, half cup-shaped, indusiate. Rhizome long, creeping, scaly.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Philippines, Thailand, Indonesia, Vietnam (POWO 2022).

Ecology. Common as an epiphyte and lithophyte in STR and STM, and usually found in the trunk zone and rock surfaces.

Phenology. Fertile period from July to September.

Dryopteridaceae Herter

***Elaphoglossum marginatum* T.Moore**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gurdum; 27°07′14″N, 088° 03′25″E; alt. 1924 m; 03.XI.2020; Rai & Moktan 0510 leg.; CUH 20293.

***Elaphoglossum stelligerum* (Wall. ex Baker) T.Moore ex Salomon**
Figure 9H

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°0′06″N, 088°14′ 35″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0099 leg.; CUH 20137.

Identification. Accidental epiphyte. Fronds dimorphic. Sterile fronds; lamina broad, lanceolate, 11.5–13.0 × 1.0–1.5 cm, subcoriaceous, acuminate, stipe 2.5–3.8 cm, scaly. Fertile fronds; lamina thick, 7.4–12.0 × 1.5–2.5 cm, linear, acute, coriaceous, stipe 2.5–4.0 cm. Veins distinct, forked. Sori globose, brown, scattered densely on the fertile lamina. Rhizome erect, creeping, scaly.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as an epiphyte and lithophyte in STR and STM, and usually found in the trunk zone and rock surfaces.

Phenology. Fertile period from July to October.

Nephrolepidaceae Pic. Serm.

***Nephrolepis cordifolia* (L.) C.Presl**
Figure 9K

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 04.IV.2019; Rai & Moktan 0032 leg.; CUH 20122.

Identification. Facultative epiphyte. Fronds clumped, 16.5–59.5 × 2.5–5.5 cm. Lamina pinnate, linear-lanceolate, apex acute, base gradually narrowed. Pinnae narrowly deltate, apex acute, base truncate, margin serrate, rachis grooved on upper surface. Veins indistinct, glabrous. Stipe terete, 8–10 cm long, light brown, covered with scales. Sori reniform to lunate, brown, arranged in one row between the costa and margin of pinna. Rhizome erect, stoloniferous.

Global distribution. Cosmopolitan (POWO 2022).

Ecology. Rare in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Fertile period from August to November.

Oleandraceae Ching ex Pic.Serm.

***Oleandra pistillaris* (Sw.) C.Chr.**
Figure 9E

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′22″N, 088°18′40″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0376 leg.; CUH 20228.

Identification. Facultative epiphyte. Fronds simple, 11.5–39.5 × 2.5–4.5 cm. Lamina linear-lanceolate, serrate margin, glabrous, apex caudate, base cuneate. Veins distinct, forked. Stipe pubescent, 1.5–3.5 cm long, rigid. Sori globose, brown, in two rows, near to costa, indusiate. Rhizome wide, creeping, scaly, margin with hair.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Philippines, Vietnam (POWO 2022).

Ecology. Common as epiphytes and lithophytes in STR, STM, and TMP, and usually found in the trunk zone and on rock surfaces.

Phenology. Fertile period from August to October.

***Oleandra wallichii* (Hook.) C.Presl**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0476 leg.; CUH 20273.

Davalliaceae M.R.Schomb.

***Araiostegia dareiformis* (Hook.) Copel.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 15.III.2019; Rai & Moktan 0009 leg.; CUH 20119.

***Araiostegia multidentata* (Wall. ex Hook.) Copel.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 02.VII.2019; Rai & Moktan 0076 leg.; CUH 20129.

***Davallia bullata* Wall.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′22″N, 088°18′40″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0382 leg.; CUH 20231.

***Davallia pulchra* D.Don**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°0′06″N, 088°14′35″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0102 leg.; CUH 20139.

Polypodiaceae J.Presl & C.Presl

***Arthromeris himalovata* Fraser-Jenk. & Kandel**
Figure 8C

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′06″E; alt. 2510 m; 17.X.2021; Rai & Moktan 0606 leg.; CUH 20346.

Identification. Holoepiphyte. Lamina oblong, 20.5–42.0 × 11.0–20.5 cm, both abaxial and adaxial surfaces pubescent. Pinnae in 3–5 pairs, up to 7.0–8.5 × 2.0–4.0 cm, oblong-lanceolate, acuminate, sessile, base round. Stipe glabrous, Sori large, orbicular, scattered in many rows along costa. Rhizome long, creeping, covered with whitish bloom, 4–5 mm in diameter.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Vietnam (POWO 2022).

Ecology. Common in higher elevations and usually found in the trunk zone.

Phenology. Fertile period from June to November.

***Arthromeris lehmannii* (Mett.) Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0504 leg.; CUH 20291.

***Arthromeris wallichiana* (Spreng.) Ching**
Figure 9F

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gurdum; 27°7′14″N, 088°03′25″E; alt. 1924 m; 03.XI.2020; Rai & Moktan 0513 leg.; CUH 20295.

Identification. Holoepiphyte. Lamina imparipinnate, oblong, 43.5–70.5 × 28.0–38.0 cm, apex acuminate, base cordate. Pinnae in 8–12 pairs, ovate-lanceolate, sessile, subopposite, 4.5–12.0 × 2.5–5.0 cm. Stipe stramineous, 14.0–29.0 × 0.5–1.8 cm. Sori orbicular, in one row on each side of main vein. Rhizome thick, creeping, densely scaly.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Vietnam (POWO 2022).

Ecology. Common in STM and TMP and usually found in the trunk zone.

Phenology. Fertile period from August to December.

***Drynaria mollis* Bedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°56′34″N, 088°19′52″E; alt. 1400 m; 26.IX.2020; Rai & Moktan 0437 leg.; CUH 20263.

***Drynaria propinqua* (Wall. ex Mett.) J.Sm.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chaityapani; 26°54′05″N, 088°17′49″E; alt. 1924 m; 02.IX.2020; Rai & Moktan 0327 leg.; CUH 20205.

***Drynaria quercifolia* (L.) J.Sm.**

Material examined. INDIA – Eastern Himalaya

• West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 24.VIII.2019; Rai & Moktan 0232 leg.; CUH 20175.

***Goniophlebium amoenum* (Wall. ex Mett.) Bedd.**
Figure 9J

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′22″N, 088°18′40″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0380 leg.; CUH 20230.

Identification. Holoepiphyte. Frond pinnate, 42.0–62.5 × 18.0–20.5 cm, ovate-lanceolate, thick. Pinnae in 18–30 pairs, simple, oblong-lanceolate, margin serrated, apex acuminate. Stipe castaneous, 11.5–23 cm. Veins distinct. Sori round, brown, on either side of the costa. Rhizome wide, creeping, covered with scales, 0.5–0.6 cm in diameter.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the trunk zone.

Phenology. Fertile period from August to November.

***Goniophlebium argutum* (Wall. ex Hook.) Bedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chimney; 26°58′22″N, 088°18′40″E; alt. 2300 m; 07.IX.2020; Rai & Moktan 0379 leg.; CUH 20229.

***Goniophlebium hendersonii* (Atk.) Bedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chitrey; 26°55′55″N, 088°18′06″E; alt. 2510 m; 02.XI.2020; Rai & Moktan 0506 leg.; CUH 20292.

***Goniophlebium lachnopum* (Wall. ex Hook.) Bedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°58′17″N, 088°22′16″E; alt. 1400 m; 30.VIII.2020; Rai&Moktan 0325 leg.; CUH 20203.

***Goniophlebium microrhizoma* (C.B. Clarke ex Baker) Clarke ex Bedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°0′06″N, 088°14′35″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0121 leg.; CUH 20143.

***Goniophlebium subamoenum* (C.B. Clarke) Bedd.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°00′06″N, 088°14′35″E; alt. 2200 m; 10.VIII.2019; Rai & Moktan 0124 leg.; CUH 20144.

***Lemmaphyllum rostratum* (Bedd.) Tagawa.**
Figure 8I

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rajahatta; 26°57′20″N, 088°17′36″E; alt. 2037 m; 09.IV.2021; Rai & Moktan 0554 leg.; CUH 20316.

Identification. Holoepiphyte. Fronds monomorphic, 10.0–12.5 × 2.0–3.5 cm. Lamina lanceolate or elliptical 5.5–11.5 × 2.0–3.0 cm, dried lamina leathery, apex acuminate, base cuneate. Stipe short, 1.0–1.8 cm. Veins slightly visible. Sori orbicular, in one row on each side of main vein. Rhizome creeping, greenish.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Taiwan, Thailand, Vietnam (POWO 2022).

Ecology. Less frequent in TMP, and usually found in the trunk and inner crown zones.

Phenology. Fertile period from March to July.

***Lepisorus contortus* Ching**
Figure 8D

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088°18′40″E; alt. 2300 m; 13.III.2019; Rai & Moktan 0001 leg.; CUH 20113.

Identification. Holoepiphyte. Fronds 11.0–12.5 × 1.0–1.5 cm. Lamina simple, linear to elliptical-lanceolate, apex acuminate, base attenuate, rachis raised on upper side. Stipe straminaceous, 1.5–3.0 cm. Veins hidden. Sori round, brown, median on either side of the rachis. Rhizome wide, creeping, covered with scales, 0.2–0.4 cm in diameter.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal (POWO 2022).

Ecology. Common in TMP and STM, and usually found in the trunk zone.

Phenology. Fertile period from August to November.

***Lepisorus loriformis* Ching**
Figure 8L

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Kanyakatta; 27°04′13″N, 088°01′05″E; alt. 2300 m; 02.XI.2020; Rai & Moktan 0493 leg.; CUH 20283.

Identification. Holoepiphyte. Frond simple, 16.5–63.5 × 1.0–2.0 cm. Lamina simple, linear, apex acuminate, subcoriaceous. Stipe 1.5–4.5 cm. Veins hidden. Sori round, brown, submarginal, exindusiate. Rhizome long, creeping, covered with scales, 2.5–4.5 cm in diameter.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Tibet (POWO 2022).

Ecology. Common in TMP and usually found in the trunk zone.

Phenology. Fertile period from July to September.

***Lepisorus mehrae* Fraser-Jenk.**
Figure 9A

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088°18′40″E; alt. 2300 m; 13.III.2019; Rai & Moktan 0005 leg.; CUH 20115.

Identification. Holoepiphyte. Herb. Fronds simple, 26.0–36.0 × 1.5–4.0 cm. Lamina linear-lanceolate, both sides attenuated. Stipe 2.5–3.0 cm, pale green. Veins distinct, reticulate. Sori round, large, arranged on either side of the rachis, exinduisate, light brown. Rhizome creeping, thick and scaly, 0.5–1.0 cm in diameter.

Global distribution. India, Bhutan, Nepal (POWO 2022).

Ecology. Common in STM and TMP and usually found in the trunk zone.

Phenology. Fertile period from July to November.

***Lepisorus normalis* (D.Don) C. f.Zhao, R.Wei & X.C.Zhang**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Sonada; 26°58′18″N, 088°16′57″E; alt. 1900 m; 07.VII.2021; Rai & Moktan 0599 leg.; CUH 20340.

***Lepisorus nudus* Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Bagora; 26°58′22″N, 088°18′40″E; alt. 2300 m; 30.VIII.2019; Rai & Moktan 0238 leg.; CUH 20180.

***Lepisorus scolopendrium* (Ching) Mehra & Bir**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling Chimney; 26°58′22″N, 088°18′40″E; alt. 2300 m; 13.III.2019; Rai & Moktan 0007 leg.; CUH 20117.

***Lepisorus sordidus* (C.Chr.) Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0364 leg.; CUH 20220.

***Lepisorus sublinearis* Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0463 leg.; CUH 20269.

***Loxogramme chinensis* Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088°22′10″E; alt. 1114 m; 11.VIII.2019; Rai & Moktan 0125 leg.; CUH 20145.

***Loxogramme cuspidata* (Zenker) M.G.Price**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 30.X.2020; Rai & Moktan 0486 leg.; CUH 20279.

***Loxogramme grammitoides* (Baker) C. Chr.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahaldiram; 26°55′03″N, 088°20′27″E; alt. 1900 m; 05.V.2021; Rai & Moktan 0571 leg.; CUH 20330.

***Loxogramme involuta* (D.Don) C.Presl**
Figure 8H

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′41″E; alt. 1900 m; 17.VI.2021; Rai & Moktan 0595 leg.; CUH 20336.

Identification. Holoepiphyte. Lamina simple, 28.0–42.0 × 3.5–4.0 cm, lanceolate, base attenuate, apex caudate-acuminate, mid-vein raised on abaxial side, flat adaxially. Veins hidden. Stipe short, indistinct. Sori golden brown, globose, linear between mid-vein to frond margin, exindusiate. Rhizome erect, short, and scaly.

Global distribution. India, Bhutan, China, India, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Fertile period from August to October.

***Loxogramme lanceolata* (Sw.) C. Presl**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chaityapani; 26°54′05″N, 088°17′49″E; alt. 1924 m; 30.VIII.2020; Rai & Moktan 0326 leg.; CUH 20204.

***Loxogramme porcata* M.G.Price**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Lower Mamring; 26°56′34″N, 088°19′52″E; alt. 1400 m; 26.IX.2020; Rai & Moktan 0433 leg.; CUH 20262.

***Microsorum cuspidatum* (D.Don) Tagawa**
Figure 8F

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 20.IX.2020; Rai & Moktan 0485 leg.; CUH 20278.

Identification. Facultative epiphyte. Lamina simple, 48.0–72.0 × 23.5–29.5 cm. Lateral pinnae in 13–26 pairs, apex tapering, base cuneate, linear-lanceolate, 9.0–21.5 × 2.0–3.0 cm, stalked. Veins distinct. Stipe glabrous, articulated, 19.0–39.5 cm, grooved. Sori brown, globose, large, exindusiate, located in one row on either side of costa. Rhizome creeping, fleshy, 5.5–9.0 mm in diameter.

Global distribution. India, Bhutan, China, India, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as epiphytes, lithophytes and mesophytes in STR, STM and usually found in the trunk.

Phenology. Fertile period from August to December.

***Microsorum membranaceum* (D.Don) Ching**
Figure 8B

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088°16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0475 leg.; CUH 20272.

Identification. Facultative epiphyte. Lamina simple, 21.0–62.0 × 5.0–8.5 cm, apex acute, base decurrent, margin entire. Veins reticulate, distinct. Stipe winged, 1.0–5.5 cm, grooved. Sori brown, globose, scattered in many rows on abaxial surface. Rhizome thick, creeping, 0.3–0.9 cm in diameter.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STR, STM, and TMP, and usually found in the trunk zone.

Phenology. Fertile period from August to December.

***Microsorum punctatum* (L.) Copel.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Panighatta; 26°47′00″N, 088°14′25″E; alt. 400 m; 23.IX.2020; Rai & Moktan 0431 leg.; CUH 20260.

***Pyrrosia costata* (Wall. ex C.Presl) Tagawa & K.Iwats.**
Figure 8G

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rongtong; 26°50′11″N, 088°20′31″E; alt. 350 m; 03.IX.2020; Rai & Moktan 0347 leg.; CUH 20209.

Identification. Holoepiphyte. Fronds monomorphic, 17.0–61.5 × 4.5–7.0 cm. Lamina simple, lanceolate, green, apex caudate, margin entire. Veins reticulate. Stipe winged, 1.0–0.3 cm. Sori brown, globose, scattered on the adaxial side. Rhizome short, creeping, 0.3–0.5 cm in diameter.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in TRP and STR, and usually found in the trunk zone.

Phenology. Fertile period from July to September.

***Pyrrosia heteractis* (Mett. ex Kuhn) Ching**
Figure 9G

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Ghoom; 27°00′06″N, 088°14′35″E; alt. 2200 m; 10.IX.2019; Rai & Moktan 0104 leg.; CUH 20140.

Identification. Facultative.Fronds subdimorphic. Sterile fronds: lamina 8.0–19.0 × 2.0–24.0 cm, apex acuminate-caudate, base attenuated, stipe 2–28 cm. Fertile fronds: lamina wide, 5.4–20.0 × 0.5–2.5 cm, stipe 1.5–22.0 cm. Sori globose, golden brown, scattered densely on the adaxial side. Rhizome wide, creeping, scaly, 0.5–0.8 cm in diameter.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common as epiphytes and lithophytes in STR, STM, and TMP, and usually found in the trunk zone and rock surfaces.

Phenology. Fertile period from July to October.

***Pyrrosia lanceolata* (L.) Farw.**
Figure 8E

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°16′00″E; alt. 550 m; 20.IX.2020; Rai & Moktan 0409 leg.; CUH 20249.

Identification. Fronds monomorphic, 5.5–11.5 × 0.3–1.5 cm. Lamina simple, narrow, lanceolate, green, apex obtuse, base attenuate, margin entire, upper surface glabrous. Main vein flat on both adaxial and abaxial sides. Stipe winged, 0.6–1.0 cm. Sori globose to subglobose. Rhizome thin, creeping, scaly.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Sri Lanka, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in TRP and STR, and usually found in the trunk zone.

Phenology. Fertile period from July to December.

***Pyrrosia mannii* (Giesenh.) Ching**
Figure 9B

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Takdah; 27°02′17″N, 088°21′41″E; alt. 1900 m; 04.IX.2020; Rai & Moktan 0355 leg.; CUH 20214.

Identification. Holoepiphyte.Fronds monomorphic, 9.5–30.5 × 1.3–2.5 cm. Lamina simple, lanceolate, green, hairy, apex and base narrowed gradually, broadest at middle. Stipe indistinct, winged. Veins invisible, main vein distinct. Sori round, red, scattered on adaxial side. Rhizome short, creeping, scaly, 0.2–0.3 cm in diameter.

Global distribution. India, Bhutan, China, Myanmar, Nepal, Sri Lanka, Thailand, Tibet, Vietnam (POWO 2022).

Ecology. Common in STR and STM and usually found in the trunk zone and inner crown zone. **Phenology.** Fertile period from July to October.

***Pyrrosia nuda* (Giesenh.) Ching**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Pankhabari; 26°50′00″N, 088°

16′00″E; alt. 550 m; 27.IX.2020; Rai & Moktan 0441 leg.; CUH 20264.

***Pyrrosia porosa* (C.Presl) Hovenkamp**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mahaldiram; 26°55′03″N, 088° 20′27″E; alt. 1900 m; 05.V.2021; Rai & Moktan 0573 leg.; CUH 20331.

***Selliguea ebenipes* (Hook.) S.Linds.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Chaityapani; 26°54′05″N, 088° 17′49″E; alt. 1924 m; 02.IX.2020; Rai & Moktan 0329 leg.; CUH 20207.

***Selliguea griffithiana* (Hook.) Fraser-Jenk.**
Figure 8K

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Upper Mamring; 26°57′16″N, 088°18′59″E; alt. 1700 m; 11.IV.2021; Rai & Moktan 0567 leg.; CUH 20326.

Identification. Holoepiphyte. Fronds monomorphic, 4.5–12 cm. Lamina simple, ovate-lanceolate, green, apex acute to acuminate, base cuneate, margin entire. Veins distinct, reticulate. Stipe stramineous, 3.5–12 cm. Sori brown, globose, large, arranged in the single row between midrib and margin, exindusiate. Rhizome long, creeping, 0.3–0.5 cm in diameter.

Global distribution. India, Bhutan, China, India, Myanmar, Nepal, Thailand, Vietnam (POWO 2022).

Ecology. Common in STM and TMP, and usually found in the trunk zone.

Phenology. Fertile period from May to October.

***Selliguea hastata* (Thunb.) Fraser-Jenk.**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Rangbull; 26°59′26″N, 088° 16′19″E; alt. 2040 m; 28.IX.2020; Rai & Moktan 0453 leg.; CUH 20267.

***Selliguea oxyloba* (Wall. ex Kunze) Fraser-Jenk.**

Material examined.INDIA – Eastern Himalaya • West Bengal, Darjeeling, Mungpoo; 26°58′23″N, 088° 22′10″E; alt. 1114 m; 11.VIII.2019; Rai & Moktan 0141 leg.; CUH 20151.

***Selliguea stewartii* (Bedd.) S.G.Lu, Hovenkamp & M.G.Gilbert**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Gurdum; 27°07′14″N, 088° 03′25″E; alt. 1924 m; 03.XI.2020; Rai & Moktan 0511 leg.; CUH 20294.

***Tomophyllum donianum* (Spreng.) Fraser-Jenk. & Parris**

Material examined. INDIA – Eastern Himalaya • West Bengal, Darjeeling, Senchal; 26°58′50″N, 088°13′48″E; alt. 2200 m; 22.IX.2020; Rai & Moktan 0427 leg.; CUH 20257.

Discussion

Our study makes a significant contribution towards understanding the vascular epiphytic richness in the Darjeeling Himalaya. Within this area, there has been few vascular epiphytic inventories (i.e., Sen 1963; Ghosh and Saha 2013), and these have been limited in scope by being restricted to a certain area. Sen (1963) reported 34 species of epiphytic flowering plants belonging to 22 genera from the region, but this is low compared to our study. However, it is of interest that *Hoya linearis* Wall. ex D. Don, *Lysionotus serratus* D.Don, *Neohymenopogon parasiticus* (Wall.) Bennet, *Peperomia heyneana* Miq., *Polygonatum oppositifolium* (Wall.) Royle, and *Vaccinium retusum* (Griff.) Hook.f. ex C.B.Clarke still occur in the study area. Ghosh and Saha (2013) carried out a preliminary survey from the upper montane tropical forests of Darjeeling Himalaya and reported 88 species, which, again, is far less than in our study. Results of these earlier studies and our own suggest that orchids are the most dominant epiphytic species in the region. Our study revealed that *Agapetes* D.Don ex G.Don, *Vaccinium* L., and *Aeschynanthus* Jack were some of the most frequently occurring genera, which supports the findings by Ghosh and Saha (2013).

Furthermore, Thapa (2016) recorded about 50 species of epiphytic fern, fewer species than we report here. However, our findings are consistent with Thapa (2016) in showing that Polypodiaceae is the most diverse and largest family. Mallick (2020) reported dicotyledons as the most dominant plant group in Darjeeling Himalaya, whereas we found that monocotyledonous vascular epiphytes were more diverse. Our study also revealed some endemic species such as *Cymbidium eburneum* Lindl., *Agapetes incurvata* (Griff.) Sleumer, and *Thunbergia lutea* T. Anderson, which have been earlier reported (Gogoi et al. 2012; Deori 2020; BSI 2022).

Our results show that species richness declines with increased elevation. This may be due to altitudinal variation, uneven topography, more extreme climatic conditions (Timsina et al. 2021), stunted vegetation (Kromer et al. 2005), or a decrease in soil fertility (Halbritter 2018). However, vascular epiphytes are more strongly associated with mid-elevational zone or temperate forests, as these forests are characterised by larger trees which offer more suitable habitat for epiphytes (Hansen et al. 2010).

The orchids *Bulbophyllum leopardinum* (Wall.) Lindl. ex Wall. and *Pleione humilis* (Sm.) D.Don are Critically Endangered (BGCI 2022). Similarly, *Agrostophyllum myrianthum* King & Pantl., *Bulbophyllum reptans*(Lindl.) Lindl. ex Wall., *B. odoratissimum* (Sm.) Lindl., *Pleione praecox* (Sm.) D.Don, *Vandopsis undulata* (Lindl.) J.J.Sm. were sparsely populated. The orchids *Aerides multiflora* Roxb., *Cymbidium erythraeum* Lindl., *Dendrobium bicameratum* Lindl., *Gastrochilus*

calceolaris (Buch.-Ham. ex Sm.) D.Don, *Porpax elwesi* (Rchb.f.) Rolfe, *Uncifera obtusifolia* Lindl. were found to be rare. Other epiphytes, such as *Holboellia angustifolia* Wall., *Hoya serpens* (Hook.f.), *Herpetospermum tonglense* (C.B.Clarke) H.Schaef. & S.S.Renner and *Polygonatum oppositifolium* (Wall.) Royle, were least common. Among epiphytic ferns, *Huperzia hamiltonii* (Spreng.) Trevis, is Endangered, while *Elaphoglossum marginatum* T.Moore, *Huperzia pulcherrima* (Wall. ex Hook. & Grev.) Pic.Serm., and *Vittaria flexuosa* Fee are Vulnerable (BGCI 2022).

We also recorded epiphytes that are known to have potential as ethnomedicines, such as *Cautleya spicata* (Sm.) Baker, which is traditionally used against stomach disorders (Choudhary and Lee 2012), *Dioscorea belophylla* (Prain) Voigt ex Haines and *D. bulbifera* L. used for treating jaundice and pneumonia (Raj et al. 2018). Orchids have also been widely used as traditional medicines. *Bulbophyllum leopardinum* (Wall.) Lindl. ex Wall. has been used for the treatment of bone fractures, *Cymbidium aloifolium* (L.) Sw. (paralysis), *Acampe rigida* (Buch.-Ham. ex Sm.) P.F.Hunt (jaundice), *Papilionanthe teres* (Roxb.) Schltr (anti-fertility medicine), *Coelogyne cristata* Lindl. (phytoalexin), and *Dendrobium chrysanthum* Wall. ex Lindl. as anti-inflammatories, and *Aerides multiflora* Roxb. for the treatment of rheumatism (Singh et al. 2012; Rahamtulla et al. 2020). Epiphytic ferns also possess medicinal value, such as *Drynaria quercifolia* (L.) J.Sm. as a blood anticoagulant, *Microsorum punctatum* (L.) Copel. for its anti-inflammatory and antibacterial properties, *Pyrrosia porosa* (C.Presl) Hovenkamp for treatment of injuries, and *P. lanceolata* (L.) Farw. for sore throats (Sathiyaraj et al. 2015). Despite their significance, many epiphytic species are under severe threat due to unsustainable harvesting by locals, ethno-medicine practitioners, and commercial collectors. Apart from human interference, overexploitation, deforestation, habitat destruction, and climate change are some notable threats to vascular epiphytes in the region (Yonzone and Rai 2017; Kull et al. 2016; Rahamtulla et al. 2020). Biodiversity conservation requires balancing the needs of people and long-term sustenance within the natural habitats, which requires implementation of effective conservation measures. It is imperative to develop awareness programmes, future monitoring, population studies, and collaborative research for the conservation of these valuable species.

Acknowledgements

Preshina Rai is thankful to University Grant Commission, New Delhi for financial assistance. We thank C.R. Fraser-Jenkins for valuable suggestions. We also thank the Department of Forests, Government of West Bengal, India for all the necessary permissions. We sincerely acknowledge the reviewers, subject editor, and copy editor for their valuable comment and meticulous editing of the manuscript.

Authors' Contributions

Conceptualization: SM. Data curation: PR, SM. Visualization: PR, SM. Writing – original draft: PR, SM. Writing – review and editing: SM.

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